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Pedagogical Diplomacy II

Diese Sonderausgabe erscheint unter der Ägide von Roman Hrmo und Lucia Krištofiaková. Ziel ist der Austausch über relevante Trends, Forschungsergebnisse und praktische Erfahrungen in der Ingenieurpädagogik.

11. Jg. (2024), Sonderausgabe 1

Ingenieurpädagogik

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Editorial

DOI: [10.53349/resource.2024.is1.a1269](https://doi.org/10.53349/resource.2024.is1.a1269)

The focus of this special issue "Pedagogical Diplomacy II" is published under the auspices of Roman Hrmo and Lucia Krištofiaková, both affiliated to DTI University, former Dubnica Institute of Technology in Dubnica nad Váhom. This special issue of R&E-SOURCE aims to share relevant trends, research results and practical experiences in engineering pedagogy.

In order for teachers to effectively fulfil their tasks (education, training and personality development of learners), they require a deep understanding of their subject, good pedagogical training and a high level of general knowledge. In this field, the activity and importance of the "Internationale Gesellschaft für Ingenieurpädagogik" (short: IGIP) occupies an irreplaceable position.

IGIP was founded in 1972 at the University of Klagenfurt by Professor Adolf Melezinek. Establishing engineering pedagogy represented a step forward at that time, because never before had engineering and pedagogy been linked on a scientific level. Already in the 1970s, European integration and standardised profiles for educators were considered the most important factors for education, training and learning. Engineering pedagogy is a scientific cross-discipline that transfers the knowledge of pedagogy and psychology into the field of technical sciences in order to increase the didactic effectiveness of education.

The subject of engineering pedagogy is the knowledge required to prepare teachers for the education of future engineers in technical subjects. IGIP promotes scientific research, coordinates and supports international efforts and activities in the field of engineering education.

The main topics covered in this volume are teacher education, engineering education, new trends in industry didactics, accreditation, curriculum development, quality in education, technical teacher education, key competencies, networks of social sciences in engineering education, information and communication technologies in education, talent development, lifelong learning, problem situations in education.

Roman Hrmo und Lucia Krištofiaková

Digital Tools in Education

The Impact of Digital Tools in Education on Students' Creativity

Mária Bajúzová¹, Roman Hrmo²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1236>

Abstract

In recent years, as we have observed, digitisation has remained a consistently debated topic, especially in education. However, we believe that increasing attention needs to be given to the issue of students' digital skills in schools, the use of digital tools in teaching, the development of creativity, and other soft skills expected of young people in the future job market. These skills are becoming increasingly crucial. In this article, we focus on using digital tools in teaching at a vocational school and their impact on the creativity of a selected research sample of students. In the first part of the article, we specifically address the definition of creativity and the specifics of a creative personality. We briefly introduce concepts such as imagination, originality, intelligence, and critical thinking. The second chapter of the article presents selected methods and techniques that support the development of students' creativity. Based on the chosen topic, we highlight the importance of digitisation and the use of ICT in teaching and briefly describe selected digital tools. The article includes an evaluation of the creativity scores of the selected research sample of students at the beginning and end of the observed period.

Keywords: Creativity, ICT, Digital Tools

Creativity

Creativity is the ability of a person to create and exists in everyone at every age. Specific methods and techniques can positively influence, develop, and stimulate it. Creativity produces new and acceptable ideas, solutions, and actions. However, definitions of creativity differ depending on various theoretical concepts, such as behavioural or psychoanalytic, which focus on intellect, process, abilities, and personality.

¹ DTI University, Sládkovičova 533/20, 018 41 Dubnica nad Váhom.

E-mail: maria.bajuzova@dti.sk

² DTI University, Sládkovičova 533/20, 018 41 Dubnica nad Váhom.

According to psychologists like Hlavsa, Jurčová, Pietrasiński, Rubištejn, and others, creativity can be characterised as an essential mechanism for personality development. It is an intellectual ability that results in creating one's discoveries, connections, new thoughts, solutions, and attitudes. It also involves the ability of logical memory, association, and the transfer of experiences.

The willingness to take risks is a characteristic of a creative personality, along with impulsivity, enthusiasm, independent thinking, and evaluation. The inclination towards "play" is another characteristic of a gifted individual. Originality without extravagance is another hallmark. Creative personalities are characterised by a love for life, broad interests, sensitivity, and a desire for knowledge.

Petrová summarised the personality traits of a creative person, stating that, on average, creative individuals have higher intelligence and intellectual capacity, flexibility, originality, sensitivity to problems, and a propensity for aesthetic feelings. They often improvise and exhibit specific abilities related to a particular type of creative activity. Creatively inclined individuals reject routine and conformity, express themselves more radically, desire freedom, and resist discipline and authority (except for authority they respect and acknowledge).

In her publication "Art Thinking" (2016), Whitaker defines creative artistic thinking as a framework and set of habits that create space for exploration and discovery. It allows dreaming big in a way that transcends reality without forgetting it. Creative thinking separates time for exploration without expecting a specific outcome, allowing for mistakes and failures. With this mindset, it becomes possible to move forward by asking significant, influential, or wild questions, whether they have answers or not.

Amabile's extensive research on creativity and motivation identifies three essential components of individual creativity: abilities related to the field, creativity and work methods, and creative techniques. She argues that creative individuals are hardworking and unafraid of challenging tasks. She also suggests that a person with experience in creative principles is likelier to engage in further creative endeavours than someone encountering them for the first time. However, a newcomer must possess certain personality traits that enable purposeful creation.

Fostering students' creativity is a long-term task of education and training strategies, teacher preparation, and a requirement of modern education. It impacts the motivational system, shapes the emotional aspect of personality, enriches critical thinking, argumentation, and evaluation of facts, and influences students' relationships and practical communication training.

Creativity and Imagination

Imagination is the source and foundation of creative activity. It enriches life and makes it unusual, but it can also serve as an escape from reality. It is connected to imagination, visual thinking, and creativity. Imagination can be developed and exercised, involving the perception

of things and people around us, an unusual view of the world, richness of associations, intuition, and playfulness (Zelina, 1997, p. 78).

Viewegh (1986, p. 12) states that the contribution of imagination to the creative process has exceptional practical significance: imagination is not a peripheral component in the creative process but a central one, and its participation in creating a creative product is undeniable. Adopting a playful attitude, seeking and exchanging new meanings, thinking in extremes, creating analogies, etc., is recommended to activate the imagination.

Other opinions from authors include those of Gawain (1991, p. 15), who describes creative imagination as using imagination to achieve what is needed in life. She considers it an innate ability for visual thinking, the fundamental creative energy of the universe that humans constantly use, whether they are aware of it or not.

Creativity and Intelligence

Giftedness, talent, and intelligence are only to a minimal extent conditioned by heredity but can be acquired and developed considerably until a person is advanced (Tepperwein, 1992, p. 35).

Ďurič (1985, p. 128) defines intelligence as an intellectual ability based on convergent thinking. He also states that the quality of orientation in problem situations, the degree of flexibility and ease in changing focus, and the selection of a suitable proposal for solving a task signalise intelligence.

Creativity and Originality

Psychologists have long discovered that there are two paths leading to success, namely adaptability and originality. Conforming to the crowd and defending the current state of affairs signifies adaptability. On the other hand, originality takes less-trodden paths and advocates unconventional values or ideas. Despite swimming against the current, these unconventional values or ideas ultimately lead to improvement (Grant, 2016, p. 17).

Nakonečný (2009, p. 216) argues that the essence of creativity is originality, but not originality at any cost; it must be socially valuable originality. Because creativity is a source of progress in science, technology, arts, and society, it has become the subject of intense interest.

Creativity and Critical Thinking

Petrová (1999, p. 20) expresses that critical thinking is not just about finding faults, as we usually associate with criticism. However, it involves examining, assessing, and evaluating thoughts, seeking evidence, considering the correctness of information, and not automatically accepting what is presented.

Sitná (2009, p. 9) addresses the topic of critical thinking from the perspective of active learning, in which the student actively engages with information and forms their judgments based on it. The student processes this information and incorporates it into their system of knowledge, skills, and attitudes. Through active approaches to acquiring information, students effectively develop critical thinking. These active teaching methods contrast with most traditional teaching methods. In active teaching methods, the student is at the centre of the educational process in the classroom, co-creating the content and the course of instruction. They participate in assessment and self-assessment; therefore, these methods are increasingly promoted and used.

Methods and Techniques Supporting the Development of Creativity

Zelina (1996, p. 193) categorises eight groups of methods for fostering creativity:

- a) Methods and techniques for creating divergent tasks;
- b) Teaching strategies to support and develop creativity, such as problem-based, project-based, or exploratory teaching research methods;
- c) Methods for developing perception and sensitivity, openness to experience, the world, readiness, and perceptual sensitivity;
- d) Methods involving tasks for wit, anti-rigid thinking, and flexible thinking;
- e) Training methods for imagination, fantasy, creativity, experiences, intuition;
- f) Methods for improving creative evaluation, including options for compromise, discussions, creativity in communication, and agreement techniques;
- g) Methods for creative problem-solving – reflective, pragmatic, and heuristic information;
- h) Methods for improving fluency, originality, and flexibility.

Activating methods

Activating methods support students' interest in learning, intense experiences, thinking, and actions. They significantly support and develop students' cognitive processes while utilising their acquired knowledge. Activating methods include:

- Dialogical (discussion) methods,
- Group teaching methods as operational learning,
- Project methods,
- Methods for developing critical thinking,
- Case methods (including situational methods),
- Role-playing (dramatisation, staging methods),
- Simulation methods,
- Discovery and guided discovery method,
- Research methods,

- Didactic games.

Classification:

- 1) Problem-solving methods - emphasise activity, productive thinking, and students' independence.
- 2) Gamification - educational games, economic games, various crosswords, fill-ins, and quizzes.
- 3) Discussion methods include brainstorming and brainwriting, Philips 66, Hobo method, and others.
- 4) Situational methods - based on a reasonable and solvable problem that may have multiple solutions and require a comprehensive approach and knowledge from various subjects.
- 5) Staging methods or role-playing.
- 6) Many unique methods, including those that cannot be classified into the previous methods, such as icebreakers or project methods mentioned above (Zahatňanská & Kušnírová, 2017).

Problem-Based Teaching

Pecina and Krištofiaková (2021, p. 61) state that the difference between a traditional teaching unit and a problem-based one lies in its preparation. Preparing a traditional teaching unit involves a project where we plan to provide students with finished knowledge through classical teaching methods such as lectures, illustrative, and practical methods. Problem-based teaching sessions are characterised by not delivering ready-made knowledge to students but guiding them to acquire new knowledge based on their existing knowledge and active cognitive engagement with appropriate teacher assistance.

Didactic Games

Play is the subject of various psychological research and interpretations because it provides an opportunity to analyse and interpret personality development, cognitive processes, and socialisation. In cognitive development in early and preschool age, play is essential for the proper development of exploratory, sensorimotor, symbolic, and later, cognitive and speech expressions. It is not only a matter of childhood and youth but also of adulthood and old age because the need for play persists in various forms (Millarová, 1968, p. 7).

Gamification supports basic human needs such as competitiveness, rewards, and self-expression. Its primary strategy is rewarding for completing tasks with awards, badges, filling progress bars, levelling up, and virtual currency (Brečka & Valentová, 2018, p. 41). These authors further list reasons to use gamification in education, including:

- Learning entertainingly,

- Increasing interaction – instead of just reading text, we are actively involved in doing something (creating),
- Increasing awareness – we can engage in a plot that helps us better understand issues that are difficult to comprehend in traditional teaching methods,
- Reward for completing challenging tasks – meeting deadlines, goals, etc.,
- Feedback for the teacher (Brečka & Valentová, 2018, p. 44).

Didactic games include not only traditional games but also computer-assisted educational games. They are most commonly used in practice for consolidating and reviewing material. These games (not only computer-based) can be verbal, such as memory games, logic games, associative games, abstract games, and written games.

Project-Based Teaching

Project-based teaching is one of the modern activating methods of instruction that allows the development of students' independence in cognitive activities and utilises interdisciplinary relationships. Based on its characteristics, project-based teaching can be classified among problem-solving methods of instruction. Students acquire knowledge and insights through the solution of suitable projects.

Project-based teaching allows for:

- Deepening and expanding knowledge,
- Developing creative thinking,
- Recognizing the significance and meaning of learning,
- Integrating knowledge into a coherent system.

Harausová describes the positives brought by project-based teaching develop the following competencies in students:

- Responsibility for their work,
- Independence,
- Activity and creative work of the student,
- Overcoming obstacles,
- Searching, selecting, and analysing relevant information,
- Communication,
- Collaboration, argumentation,
- Presenting their work,
- Planning,
- Evaluating,
- Tolerate and accept different opinions (Harausová, 2011, p. 28).

Discussion Methods

Through discussion methods, students learn communication, discussion, and the defence of their opinions, thoughts, and arguments, as well as listening to and perceiving the opinions of

others in the group, which can lead to the cohesion of the student group in the classroom. In addition to the discussion, debate can also be utilised, as according to authors Schulcz et al. (2017; cited in Zahatňanská & Kušnířová, 2017), it supports and develops:

- Critical thinking – the ability to work with information, evaluate it, and categorise it, the ability to distinguish credible and essential information;
- Good argumentation – the ability to defend one's opinions;
- General knowledge – acquiring and seeking relevant information;
- Team collaboration;
- Effective dialogue skills – listening to others, being able to express oneself precisely, convincingly, and concisely, asking appropriate questions, and responding to them;
- Presentation skills – learning communication, presentation, and building self-confidence.

Digital Technologies and ICT Tools in Teaching

With the advancement of science and technology, modern approaches in education are coming to the forefront, aiming to streamline individual phases of the teaching process and create a positive and creative atmosphere in education. The gradual incorporation of these attributes into educational processes is slowly moving away from the traditional school approaches (Brečka & Valentová, 2018, p. 28).

Authors Zounek and Šedřová (2009) include modern audiovisual and digital technologies in the group of information and communication technologies (ICT), enabling users to access and work with information further, such as interactive boards, the internet, digital cameras, and various forms of communication like email. The acronym ICT refers to all technologies used for working with information and communication. The concept of information technology has thus been supplemented with a communication element. Information and communication technologies, however, are not just hardware elements (computers and servers) but also include software (operating systems, internet browsers, network protocols, etc.) (in Brečka & Valentová, 2018, p. 49).

According to Kalaš (2011), the acronym ICT generally refers to procedures, means, and knowledge used for processing and communicating information. In education, it involves specific computing and communication tools, information sources, and procedures designed to support teaching, the learning process, and other educational activities (in Brečka & Valentová, 2018, p. 50).

Creative teaching requires the development of the application of information technologies for teachers (knowledge, tools, and methods for creating, storing, searching, and disseminating information about the methodology of creative teaching), the use and creation of didactic programs (computer software for teaching or the use of virtual reality in teaching, etc.), the development of methods for pedagogical creativity diagnostics, and the application of technical teaching tools in creative teaching (Lokšová, 2002, p. 66). Lokšová also adds that

the teacher is a central factor in creative teaching. They understand the theory of creativity and didactic means of developing students' creativity and applying them in the practice of creative teaching. She adds that "new forms and new didactic techniques such as computers, the internet, and multimedia" also enter into this type of teaching (2002, p. 56).

Selected Digital Tools in Teaching

The integration of ICT (Information and Communication Technology) significantly contributes to the development of constructivist education, as it allows students to acquire knowledge independently. However, at the European Commission level, the term IKT (Information and Communication Technology) is replaced by the term digital technology because the term IKT narrows down the meaning, while digital technology provides a broader space for its definition as a means for exploration, creation, and exploration (Bobot & Jakubeková, 2012; in Brečka & Valentová, 2018, p. 50). The platform supports applications and other technologies. By educational platform, we mean interactive online and offline services that provide resources, tools, and information for managing, supporting, and developing education for those involved in the educational process (Brečka & Valentová, 2018, p. 52).

To improve teaching and incorporate digital technologies into specialised subjects, we have selected online and offline tools, collectively called digital teaching tools. Here is a brief description of the selected tools:

Canva

A web platform for graphic design that allows the creation of graphics, social media presentations, video presentations, posters, business cards, invitations, social media posts, brochures, flyers, collages, resumes, book covers, and more. It includes customisable templates and a database of high-resolution photos and images and supports team collaboration.

Prezi

Cloud-based software for designing and creating videos and presentations utilising zoom effects and transitions between points. It offers an EDU version for students and educators at a monthly fee of \$3.

Adobe Express

A package of Adobe applications for creating simple videos, websites, social media posts, flyers, logos, posters, invitations, business cards, and more. It includes a database of templates, photos, and editing tools. Various licenses remove watermarks and provide access to templates, images, support, branding, and collaboration.

Mentimeter

An application is suitable for feedback, interactive presentations, voting, polling, and brainstorming. Respondents can participate in real-time using their mobile phones or tablets.

Plickers

A tool for testing, evaluation, or feedback, usable on mobile phones or tablets. It is suitable for quickly testing students and supports importing text from Word, PowerPoint, or the Internet. The free version allows the creation of up to five questions.

Drilleo

It is a simple web application designed to remotely test students' knowledge, sharing, and online assessment. The application was developed by Slovak creators from OpenLab in response to the situation associated with the COVID-19 pandemic to assist teachers and students in schools.

G-sites

Google application that allows the creation of simple websites for those who do not know programming languages and website development. It provides the option of free sign-up through a Google account (Gmail).

Blogger

Google application for creating web blogs allows sharing photos, videos, and text. The application can be downloaded to a mobile device as well. It enables the creation or editing of posts with the ability to publish them instantly, view a list of posts, and switch between multiple accounts and blogs.

Studenthosting

The *Webglobe* platform for schools, teachers, and students is designed to create non-commercial WordPress websites without advertisements, with the option to register a domain. It offers a large variety of templates for easy website creation. The Simple WebEditor package is intended for complete beginners to create small, simple pages and is free of charge. When opting for other packages such as shared web hosting, WordPress hosting, or a Virtual Private Server (VPS), the prices range from €1.99 to €10.16 per month.

Videoscribe

The software from Sparkol is for creating whiteboard animations that can be narrated. It includes many shapes and objects that can be used to create animated videos. License prices vary depending on whether you choose a browser-based license, a desktop version, or a group version.

Actionbound

This online application uses gamification tools that utilise various features, including GPS map content, images, and the ability to create questions, descriptions, and pictures. Upon completion, the application generates a QR code for sharing and accessing the app via a mobile phone. The mobile application can be downloaded from the Google Play Store. An advantage is the ability to track results, the number of participants involved, their ratings, and more. It offers multiple licenses ranging from business to educational.

Jamboard

The Google Jamboard application is suitable for note-taking, labelling, and drawing, offering the option for team collaboration (contributing to a single Jamboard). Completed Jamboards can be saved in PDF format or as an image and shared.

Padlet

It is an online tool for creating digital bulletin boards and sharing them. It allows you to share texts, images, and links, create presentations, and be used as a blog or portfolio. It also enables selecting an environment as a map, timeline, canvas, or bulletin board. In the free version, you have access to three Padlets after registration.

Miro

The platform you describe is likely Miro, a digital collaboration platform designed to facilitate team communication and project management. It shares similarities with Padlet but operates at a more professional level. It offers features like saving in various formats (PDF, image), sharing, linking, and more. Miro allows the creation of different types of maps, including mind maps, and can be used for recording ideas during brainstorming sessions with students.

Kahoot

Kahoot is an educational platform based on gamification. This tool allows the playful creation of quizzes through a PC or mobile phone. It is suitable for testing students' knowledge, formative assessment, or as an entertaining and educational element to make teaching more engaging. Participants can answer questions using Android or iOS mobile devices. Licenses are divided into teacher, private, and business categories.

Learningapps

The platform Learningapps.org is used to create straightforward educational games, offering various options such as Who Wants to Be a Millionaire, crosswords, memory games, horse racing, matching words and pictures, word completion, and many others. The created games can be shared with students.

The Impact of Selected Digital Tools in Teaching on Students' Creativity

We selected third-year students from two study programs at a real vocational high school to implement our research. At the beginning of the 2022/2023 school year, we used Likert scales to assess students' creativity using the Kellogg Creativity Test developed by Northwestern University. We obtained initial data on students' creativity scores before integrating digital tools into teaching. The second testing took place at the end of the school year. Twenty-four third-year students, whom we initially selected as our research sample from the real vocational high school, participated in the testing.

The test consisted of forty questions, and students had to choose from three options: A, B, or C, for each question. At the end of the test, students were shown the creativity score they achieved. They had the opportunity to compare this score in a table:

Table 1: Comparative Data

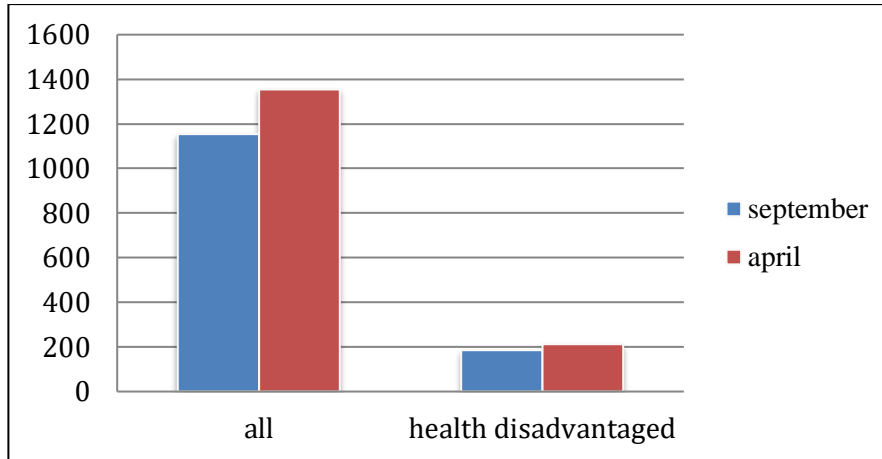
95 – 116	Exceptionally creative
65 – 94	Very creative
40 – 64	Above-average creative
20 – 39	Average creative
10 – 19	Below average
Below 10	Non-creative

(Source: <https://www.kellogg.northwestern.edu/faculty/uzzi/ftp/page176.html>)

The selected group of students achieved a total creativity score of 1153 points during the initial testing. The lowest scores were 31 and 32 points. The highest score among the selected group was seventy-two points. Students with learning disabilities in the chosen group collectively scored 184 points.

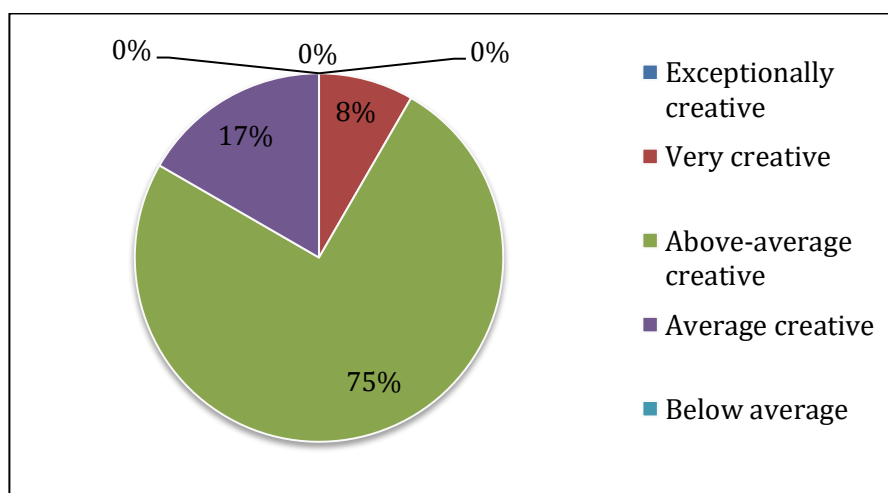
In the second test at the end of the school year, this group of students achieved a total creativity score of 1355 points. Students with the initially lowest scores showed a significant increase, with one student increasing from 32 to 51 points compared to the first creativity test. Another student who initially scored thirty-one points increased to thirty-seven points by the end of the school year. The highest increase was observed in a student who scored fifty points initially and reached ninety-three points at the end of the school year, an increase of forty-three points. Other students also showed a notable increase of more than fifteen points in their creativity scores. However, out of the research sample, only one student scored four points lower at the end of the year. Students with learning disabilities also experienced an increase, scoring two hundred-eleven points at the end of the school year compared to the initial state, the scores increased by two hundred two points for the selected group of

students, representing an increase of more than 15% in creativity scores. Similarly, students with learning disabilities showed an increase of twenty-seven points.

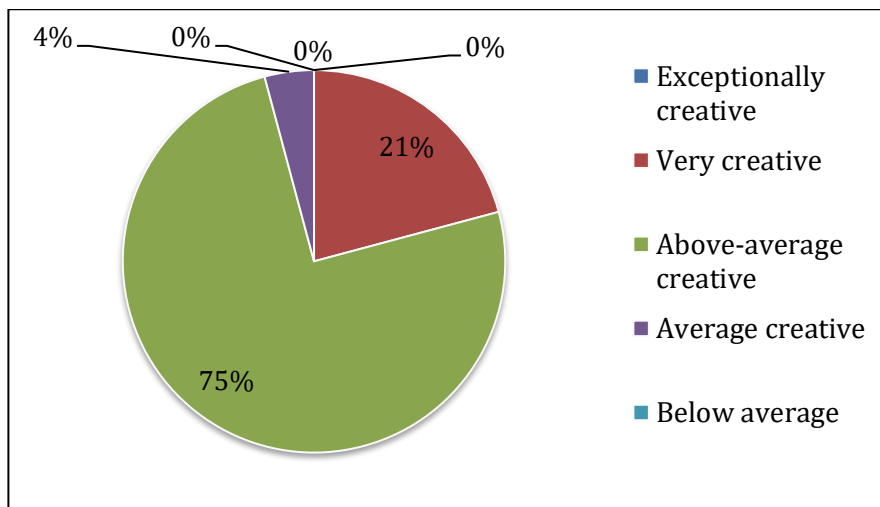


Graph 1: Creativity Scores of the Selected Research Sample of Students

In the following two graphs, we present the distribution of students in the point scale of the creativity test. We can observe that in the first testing, there was a higher number of students with average creativity compared to those who achieved scores in the very creative range. However, this situation changed in the second testing at the end of the school year, where the number of students with average creativity decreased to one, and the number of very creative students increased from two to five. The number of above-average creative students remained unchanged. Their point scores were not the same; upon closer inspection of specific student results, they increased, but not enough for these students to enter a higher point scale into the wildly creative level. A positive aspect, however, is that several students in the selected group significantly improved their creativity.



Graph 2: Creativity Scores of the Selected Research Sample of Students at the Beginning of the School Year



Graph 3: Creativity Scores of the Selected Research Sample of Students at the End of the School Year

Conclusion

As Binder (1981, p. 135) notes, a student remembers what he could use in his activities, based on which he solved his problems and what significantly interested him. Like many other authors and experts, he states that a student generally remembers:

- 10% of what they read
- 20% of what they hear
- 30% of what they see
- 50% of what they hear and see
- 70% of what they say
- 90% of what they say about what they did.

Based on these and other findings related to the topic, it can be assumed that using digital tools in teaching and involving students in activities using these tools can improve the teaching and learning processes. Based on the research conducted on a selected sample of students and the results obtained from measuring their creativity scores, in which there was an increase, we assume that integrating digital tools into teaching and implementing activities helps support students' creativity. Their use can be a tool for improving teaching and fostering creativity, not only for healthy students but also for students with learning disabilities, for whom these tools enable better understanding and memorisation of the material because they engage additional senses, stimuli, and learning methods besides listening to the teacher's lecture, reading, and memorisation.

Students become directly involved in various activities through graphical representation and working with graphics and visualisation. This approach can lead to a better understanding of information, improvement of students' abilities and skills, support of

creative thinking, and development of other soft skills, such as enhanced communication and presentation skills, teamwork, and critical thinking. Lastly, modern and engaging teaching can make a subject more attractive and improve the overall teaching quality, which may increase student motivation. We believe that modern technologies and ICT tools are essential in education, and their utilisation has become an integral part of student learning at all levels and fields. The selected digital tools are user-friendly, as working with them is straightforward and interactive without extensive training.

Acknowledgements

The authors gratefully acknowledge the contribution of the KEGA Grant Agency of the Slovak Republic under the KEGA Project 002VŠDTI-4/2022 „Creation of an interactive support tool for beginning teachers of upper secondary education in Slovakia“.

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Subjective Perception of School Openness by Vocational School Teachers in Slovakia

Silvia Barnová¹, Slávka Krásna¹, Gabriela Gabrhelová¹, Zuzana Geršicová¹, Marek Vochozka²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1237>

Abstract

The proposed paper presents the partial results of a research study on the perceived quality of the organisational climate in Slovak vocational schools, focusing on the situation in individual self-governing regions in Slovakia. The authors attempt to confirm a hypothesis presuming the existence of statistically significant differences in the evaluation of school openness between groups of teachers working in different parts of Slovakia caused by regional differences. For the carried-out investigation, the OCDQ-RS scale by Hoy, Tarter, and Kottkamp adapted to the conditions of the Slovak Republic was used. The results confirmed the existence of differences in the subjective evaluation of school openness according to self-governing regions, which is an essential finding for school leaders, especially in the context of the leadership style they apply, but also for policymakers from the aspect of introducing measures to eliminate the existing regional differences in Slovakia.

Keywords: Organisational climate, School openness, Vocational schools, Slovak Republic

1 Introduction

School organisational climate is a relatively durable quality defined by Platania, Morando, and Santisi (2022) as a multidimensional construct. It refers to the overall climate and environment typical for an educational institution, which is characterised by collective (Hellriegel, 2008) or shared (Hoy, 2022) perceptions of behaviour, work environment (Weijie & Taek, 2022), prevailing attitudes, shared values, evaluations (Herdman & McMillan-Capehart, 2010), norms, practices, policies, and procedures (Schneider et al., 2013) that shape the interpersonal relationships and interactions (Obdržálek, Horváthová et al., 2004) within the school, i.e.

¹ DTI University, Ul. Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovak Republic.

E-mail: barnova@dti.sk

² Institute of Technology and Business in České Budějovice, Okružní 517/10, 370 01 České Budějovice, Czech Republic.

among students, teachers, students' parents, administrators, and other stakeholders. Undoubtedly, a school's organisational climate has an undeniable impact on its functioning, as well as on its overall success or failure (Khun-Inkeeree et al., 2021) on the educational market.

The quality of the organisational climate impacts how people feel and behave in a school. Therefore, it is worth paying attention to creating such conditions for teachers, which they subjectively evaluate as favourable. Suppose stakeholders subjectively perceive the organisational climate as positive. In that case, it can provide comfort within the organisation and positively impact teachers' work and their and students' performance (Kapa & Gimbert, 2017). The importance of a positive working experience from the aspect of teachers' job satisfaction is highlighted by Affolter (2019), who also accentuates the existence of a link between positive perception of various phenomena in schools and teachers' work engagement. According to Ulich and Wülser (2004), job satisfaction is closely related to individuals' needs and compliance with various job characteristics. They also draw attention to the instability of job satisfaction, which they characterise as a short-term reaction based on individuals' subjective evaluation of work conditions.

Based on the above, it can be assumed that a positive organisational climate has the potential to make achieving a school's goals more manageable (Hashimoto & Maeda, 2021) and since the teachers' satisfaction in the school can increase their productivity and performance quality, school managements should invest time and energy into creating positive both social and physical school environments promoting the internal systems' healthy functioning.

1.1 Subjective evaluation and teacher job satisfaction

A range of factors influences the quality of organisational climate – including factors both inside and outside the school – and therefore, each school's organisational climate is unique. Being a subjectively perceived characteristic, it must be pointed out that individual stakeholders can evaluate it differently based on the quality of their interactions within the school environment (Hashimoto & Maeda, 2021), their personalities, experiences, education, social or cultural background, etc. to the extent that there may be individuals who are extremely satisfied with the organisational climate but also teachers, students, or parents that perceive it as harmful. Moreover, this evaluation of the quality of organisational climate may develop over time, which is a natural process under the influence of gaining new experiences in the context of a particular school, as well because of personal and professional development. Such experiences can lead to both comfort and discomfort in teachers, which not only affect their attachment to the school (James & McIntyre, 1996). Still, they can also influence the school's overall functioning and the quality of interactions within the institution. Suppose teachers perceive the organisational climate as unhealthy. In that case, it can lead to a loss of motivation and enthusiasm or even teachers' job dissatisfaction (Hur et al., 2016) and, subsequently, to decreased performance. These factors are vital as they can affect the

organisation's functioning, interactions between individuals, and their emotional response and attachment to the organisation.

The quality of school organisational climate is a predictor of teacher job satisfaction (Khun-Inkeeree et al., 2021; Hashimoto & Maeda, 2021), which is a crucial phenomenon when the teaching staff's stability is considered, since – as pointed out by Ladd (2001) – if the existing conditions are perceived as negative or unsatisfactory, it may lead to teachers' decision to leave the school. Therefore, to prevent teacher fluctuation, measures should be taken in each school to achieve high levels of teacher job satisfaction, i.e. to create an organisational climate that provides the highest possible level of comfort and satisfaction in the institution (Khun-Inkeeree et al., 2021) by providing space for self-development and self-realisation in a positive, stimulating, and motivating environment.

Teacher job satisfaction is a complex, multi-faceted concept. It is a result of subjective experiences associated with teachers' positive feelings in their roles as educators, and so, in one school, there are teachers with various levels of job satisfaction. It is influenced by multiple factors influencing teacher job satisfaction, while not all of them are associated with their work.

1.2 Factors Impacting School Organisational Climate

School organisational climate is a dynamic concept determined by a range of factors, which are assigned various influences by diverse authors depending on the approach they apply. Cohen et al. (2009) focused on the impact of social interactions, administrative and academic practices including the used leadership style in the school, but there are also other frequently mentioned factors, e.g. the composition of classes, the teaching staff, other professionals in schools, the non-teaching staff, individual characteristics of teachers, students, organisational structure, etc. From the presented research study's perspective, the below factors having an impact on school organisational climate are essential:

1. School culture – School culture is defined by shared values, beliefs, assumptions (Hoy, 2022), traditions, attitudes, and behaviours characteristic for the overall environment within an educational institution. School culture determines how community members (students, teachers, non-teaching staff, administrators, and students' parents) interact and what approaches to teaching and learning are applied. All these factors shape the school culture and are decisive from the aspect of achieving (not only) educational goals and healthy interactions within the school environment (Bočková et al., 2017), as well as a school's success (Teasley, 2017). The responsibility for the character of school culture is often wrongly assigned exclusively to school leaders – it is often forgotten that all members of the school community shape school culture. On the other hand, school leaders and their work can set a tone for school culture (Easton-Brooks et al., 2018).

2. Leadership style – There is some research evidence (e.g. Bush, 2021) that the applied leadership style is influenced by school culture and vice versa, but also that leaders alone cannot create a positive school culture – and subsequently favourable organizational climate – although they have the power to influence it strongly (Hallinger & Heck, n.d.). In this context, the applied leadership style has a crucial role to play.

Leadership style can be defined as an approach or manner in which school leaders exercise authority, make decisions, communicate, and guide the educational organization. Different leaders may employ various styles based on their personality, beliefs, and the specific context of their leadership role. Even though the employed leadership style has either a positive or negative impact on the organisational climate, there needs to be a consensus about which leadership style leads to the best results, and leaders usually apply a combination of them depending on the current circumstances and the goals to be achieved. Bush (2003) distinguishes between eight basic leadership styles: 1. managerial leadership; 2. transformational leadership; 3. participative leadership; 4. political and transactional leadership; 5. post-modern leadership; 6. moral leadership; 7. instructional leadership; and 8. contingent leadership.

3. Teacher engagement – Teacher engagement is a long-term characteristic (Kärner et al., 2021), which refers to teachers' commitment, enthusiasm, and dedication influenced by their attitudes towards their profession. Schaufeli and Bakker (2004) describe it as a positive state of mind for which vigour, dedication, and absorption are characteristic.

Teacher engagement is associated with teachers' career satisfaction (Timms & Brough, 2013; Shaver & Lacey, 2003) and with overall school effectiveness and student success. Engaged teachers are more likely to invest time and energy in their teaching, foster positive relationships with students, collaborate with colleagues, and contribute to the overall improvement of the educational environment. It has also been confirmed that teachers' work engagement can be increased by providing autonomy (Rothman & Fouché, 2018).

4. Relationship and interactions – From creating a positive and effective learning environment, relationships in schools and the stakeholders' willingness to collaborate and support each other (Lajčin & Porubčanová, 2021) are foundational. These include relationships between students and teachers, teachers and administrators, peers, and the broader school community. The quality of relationships in schools is, according to Obdržálek et al. (2002), a relatively long-term characteristic. Still, it must be pointed out that it is influenced by various external and internal factors, including teachers' personalities, the applied leadership style, etc. Investing time and effort into building and maintaining positive relationships in schools can create a positive, supportive, and inclusive organisational climate and promote holistic development in students. A positive school organisational climate with healthy interaction can be characterised by trust and loyalty (Kanu et al., 2022).

1.3 The Concept of School Openness

In the present study, we operate with school openness, for which open communication, mutual respect and support, collaboration, shared responsibility, clearly defined rules, and trust are typical. Cultivating school openness is a continuous process targeted at improvement that requires all stakeholders' involvement. Hoy (2022) accentuates that the degree of school openness that can be assigned to a particular school is between open and closed. While in open schools, teachers and leaders are supportive, genuine, and engaged, closed schools lack authenticity, and game-playing and disengaged behaviour occur in them.

2 Methods

In the Slovak Republic, there needs to be more research in the field of school organisational climate. The associations between school organisational climate and teachers' resilience levels are investigated as a part of the international project – grant number IGA003DTI/2022 Vocational School Teachers' Resilience. This paper presents the partial results of the research study carried out with the grant project focused on the quality of organisational climate and regional differences in the subjective evaluation of school openness among vocational schoolteachers in Slovakia.

2.1 Research Sample

The research sample consisted of 474 Slovak vocational schoolteachers from all eight self-governing regions in the country (see Table 1). All age groups of teachers with a diversity in the length of their teaching experience were represented.

Table 1 Composition of the sample according to self-governing regions

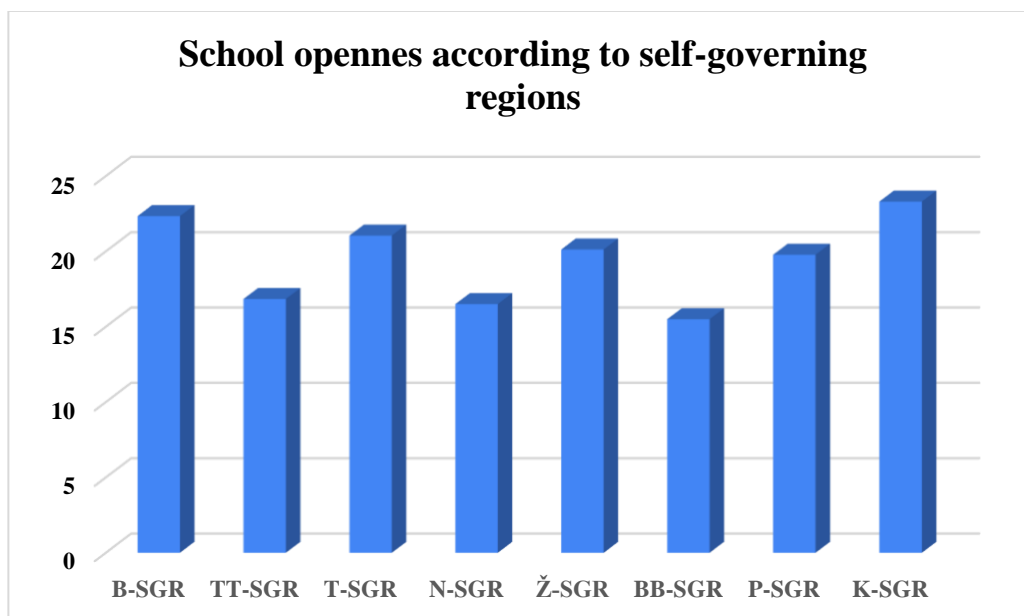
<u>Teachers</u>	<u>Gender/Self-Governing Region</u>				<u>Total</u>	<u>%</u>
	<u>Male</u>	<u>%</u>	<u>Female</u>	<u>%</u>		
Bratislava	33	6.96%	81	17.09%	114	24.05%
Trnava	9	1.90%	48	10.13%	57	12.03%
Trenčín	42	8.86%	75	15.82%	117	24.68%
Nitra	27	5.70%	9	1.90%	36	7.59%
Žilina	6	1.27%	18	3.80%	24	5.06%
Banská Bystrica	27	5.70%	33	6.96%	60	12.66%
Prešov	15	3.16%	12	2.53%	27	5.70%
Košice	21	4.43%	18	3.80%	39	8.23%
Total	180	37.97%	294	62.03%	474	100.00%

2.2 Research tool

In the present study, the standardised OCDQ-RS – The Organizational Climate Description for Secondary Schools (Hoy, n.d.) – developed by Hoy, Tarter, and Kottkamp (Hoy, Tarter, & Kottkamp, 1991; Hoy & Tarter, 1997) and adapted to the conditions in the Slovak Republic by Gavora and Braunová (2010) was used. The scale consists of 34 items examining the following five dimensions – 1. Supportive principal behaviour (SPB), Directive principal behaviour (DPB), Engaged teacher behaviour (ETB), Frustrated teacher behaviour (FTB), and Intimate teacher behaviour (ITB). The respondents indicated the frequency of certain phenomena's occurrence in schools on a 4-point Likert scale ranging from 1 = rarely occurs to 4 = very frequently occurs. Based on the calculated scores for individual dimensions, the index of school openness was computed as $IO = (SPB + ETB) - (DPB - FTB)$. The Scale was administered online. The gathered data were processed, and further analysis was carried out in SPSS 22.00.

3 Results

The analysis of the situation in the field of the existence of associations between the subjectively perceived degree of school openness by vocational schoolteachers and the region (self-governing region) in which they work has brought some interesting results.



Note: B-SGR – Bratislava Self-Governing Region; TT-SGR – Trnava Self-Governing Region; T-SGR – Trenčín Self-Governing Region; N-SGR – Nitra Self-Governing Region; Ž-SGR – Žilina Self-Governing Region; BB-SGR – Banská Bystrica Self-Governing Region, P-SGR – Prešov Self-Governing Region; K-SGR - Košice Self-Governing Region

Figure 1: School openness according to self-governing regions.

As it is displayed in Figure 1, the highest scores were achieved by vocational schoolteachers in Košice Self-Governing region, which was followed by Bratislava Self-Governing Region, Trenčín Self-Governing Region, Žilina Self-Governing Region, Prešov Self-Governing region, Trnava Self-Governing Region, and Nitra Self-Governing Region. The lowest score was achieved in Banská Bystrica Self-Governing Region. Based on the obtained results, the self-governing regions can be divided into three groups, within which the achieved scores were comparable. The calculated scores for school openness indicate that school organizational climate is most positively perceived in the only two self-governing regions, in which no rural areas or villages are included – Košice and Bratislava. It suggests that teachers working in towns or cities are more satisfied in their schools. The second group is formed by Trenčín Self-Governing Region, Žilina Self-Governing Region, and Prešov Self-Governing Region; and the third group includes Trnava Self-Governing Region, Nitra Self-Governing Region and Banská Bystrica Self-Governing Region. In the characteristics of the self-governing regions included in the second and the third groups, no apparent differences were observed that explain why teachers perceive their schools' organisational climate differently. Therefore, further research is needed in the field.

4 Conclusion

In the Slovak Republic, research activities in the field of school organisational climate are rare, and it can be assumed that, in general, vocational schools represent a neglected field of interest. We intended to fill the gap in the discussed field by realising the grant project. The above-presented partial results show that teachers' subjective quality of school organisational climate varies according to self-governing regions.

Despite the limits of the above-presented research study given by the size and the composition of the research sample consisting of vocational schoolteachers, the obtained results can contribute to the current knowledge in the field. Since they do not fully explain the differences between individual self-governing regions and cannot be generalised to the population of Slovak vocational schoolteachers, they can serve as a basis for further research activities.

5 Acknowledgement

The paper outputs the grant project IGA003DTI/2022 Vocational School Teachers' Resilience.

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Problematic Behaviour Among Students in Secondary Schools and the Role of Educational Counsellors

Marta Bednárová¹, Oľga Ilenčíková²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1238>

Abstract

Nowadays it is very important to focus on selecting a topic. Students begin to adopt various types of problematic behaviours in the education system. They engage in problematic behaviour in interactions not only with their peers, but also their teachers. Compared to the situation in other countries, the prevalence of such behaviour is still low in our country. Nevertheless, the present study is aimed at addressing those issues. Humiliation, bullying, truancy and similar behaviour constitute a problem that occurs at an increasing frequency and might transform into major pathological phenomena.

Keywords: Problematic behaviour, Secondary school students, Causes of problematic behaviour, Upbringing adviser

1 Introduction

“In students and through students, schools strive to prepare and support the future human society.” (J. Kalinčiak)

A school, as an institution, plays a key role in the lives of young people. It is a place where students learn about basic subjects, such as mathematics, history, literature, and other scientific disciplines. In schools, individuals develop and prepare for their future, while their character is being shaped. Another reason why schools are important is that they teach students how to think critically and analyse the received information. Moreover, schools

¹ Stredná odborná škola obchodu a služieb, Piešťanská 2262/80, Nové Mesto nad Váhom, Slovakia.

E-mail: marta.bednarova@prvasosnmnv.sk

² Stredná odborná škola obchodu a služieb, Piešťanská 2262/80, Nové Mesto nad Váhom, Slovakia.

E-mail: olga.ilencikova@prvasosnmnv.sk

provide young people with the opportunity to discover hobbies and develop their capacities. Various school activities, such as sporting and art, facilitate the development of the students' individual identities and self-confidence. Through collaboration and communication, they build relationships with their peers, which are important for both their personal growth and the future environment. However, despite all of that, teachers have increasingly been encountering problematic behaviour by students, and this increasing frequency constitutes a serious problem. As a result, such behaviour should be paid increased attention.

The problematic behaviour of students may include a wide range of undesirable forms of conduct, including aggression, disrespectful behaviour towards teachers, bullying, stealing, cheating, truancy, ignoring orders given by teachers, and interrupting the education and training process. At present, we are regularly witnessing attacks in schools and the misuse of narcotics and psychotropic substances. Other increasing problems are facilitated by a lack of parents' interest to participate in the education process, as well as the fact that students are paying too much attention to social media or to inappropriate computer games, and their physical activity is insufficient. All these negative phenomena may cause the development of aggressive behaviour and the extinction of emotions. Other reasons may include dysfunctional families and society, as well as a crisis of values that affects the mental balance of students.

The current political, economic, and social situation has a strong effect on students, and consequently alters their core values and behaviour, which eventually become different from those values that are taught in schools. The influence of media and appropriate role models may also impair their mental health, which is crucial for the proper development of young people.

2 Substance of Problematic Behaviour

Problematic behaviour is a term that means behaviour of an individual that causes problems to the individual itself, to others or to the society. It is improper, disturbing, aggressive or destructive behaviour and may include aggression, conflict, inability to cope with emotions, addictions, criminal behaviour, and maladaptive behaviour in respect of the social norms.

Horňák stated that problematic behaviour among students may be regarded improper particularly due to their failure to abide by the requirements determined for the school environment. In such a case, it is impossible to identify the boundaries of problematic behaviour. In general, problematic behaviour is attributed to exceptionally sensitive and unwilling students. It should be noted that particularly the term "*exceptionally*" is what distinguishes normal behaviour from problematic behaviour. Less serious characteristics are present in basically all students; however, students with problematic behaviour present with such characteristic more frequently and at an increasingly higher intensity. (Horňák, 2014)

Problematic behaviour in adolescents consists of minor disciplinary offences, demonstrations of resistance, anxiety and even aggression, as well as criminal offences. Not all types of undesirable behaviour may be classified as problematic behaviour.

Valihorová described the types of undesirable behaviour which may be regarded as problematic:

1. Behaviour of an individual who behaves that way while being fully aware of the respective social norms, i.e. the individual knows those norms and knows certain behaviour is not tolerated and in conflict with those norms, and still violates them and behaves in an inadequate manner.
2. Behaviour of a person with generally good mental health and normal personality (excluding, for example, behavioural disorders caused by a permanent and irreparable change in any of the bodily organs or functions; mental manifestations that are caused by various types of organic damage to the brain or disorders of the bodily organs; and behaviour of individuals who are difficult to educate, diagnosed as psychopathic, neurotic, or psychotic). (Valihorová, 2011)

The facts indicate that problematic behaviour is deliberate inappropriate behaviour of a completely healthy individual who is aware of behaving in conflict with the social norms.

2.1 Categorization Criteria for Problematic Behaviour Factors

- 1) According to Kalhous and Obst, the factors that cause problematic behaviour are divided into the following categories:
- 2) Biological factors – congenital, acquired during pregnancy or caused by an injury as the deviations in the body constitution and the function of the nervous system, for example ADHD.
- 3) Social factors – for example, the impact of the upbringing environment in the family; the impact of the group dynamics in the class; the impact of friends, a broader community, and the media.
- 4) Situational factors – the immediate atmosphere in the classroom; events that occurred during the previous lesson; or an uninteresting presentation of the lecture by the teacher. (Kalhous and Obst, 2009)

According to Kafka, behavioural disorders are categorised as:

1. Primary – initial disorders, such as age-related behavioural disorders of children and young people, e.g. speech disorders, disorders of school capabilities and emotional disorders. Disorders at the mental level of conduct and interactive disorders.
2. Secondary – derived from the primary disorders.
3. Interpersonal – personality disorders.
4. Extra personal – caused by the effects of the surrounding environment. (Kafka, 2015)

Based on the categories above, it may be stated that the causes of problematic behaviour are varied. It is therefore necessary to eliminate those causes in schools to the maximum possible extent with the assistance of respective experts.

2.2 Problematic Behaviour in Slovakia

The latest knowledge of problematic behaviour among students in secondary schools may be obtained from numerous research studies, as indicated in a paper by Žoldák, who presented a review of what teachers consider the most important form of behavioural disorders. Based on his research 51% of teachers stated it was truancy; 32% of teachers believed it was bullying; 13% thought it was experimenting with drugs; and 4% stated it was stealing. Žoldák also stated that the causes of problematic behaviour, as perceived by teachers, include inadequate upbringing environment in 46%; excessive impact of media and social networks in 30%; genetic predisposition in 14%; and a negative impact of peer groups in 10%. Teachers reported that they address problematic behaviour in students in cooperation with a pedagogical and psychological counselling centre in 32%; the school principal in 26%; an educational counsellor in 19%; a school psychologist in 17%; and the police in 6%. (Žoldák, 2020)

Džavoronková stated that 54% of teachers believed that the behaviour of students in secondary schools is affected by the family environment, while 46% of teachers thought it is affected by the social environment, 74% of teachers stated that the cause of problematic behaviour is their desire to attract attention; 18% thought that the cause is the rivalry among students; 6% believed it is the inferiority complex; and 2% stated other reasons. As for the most frequently occurring forms of problematic behaviour that the teachers encounter in secondary schools, 78% of teachers reported lying; in 70% it was insubordination; in 54% it was the use of vulgarisms towards other students; in 46% it was the use of vulgarisms during the lessons; in 34% it was physical violence towards other students; in 34% it was bullying; in 32% it was the destruction of the school property; in 32% it was arriving late to school; in 32% it was escaping from school; in 30% it was negativism; in 24% it was the use of vulgarisms towards the teachers; in 10% it was stealing; in 4% it was a self-directed physical violence; and in 2% it was physical violence directed towards the teachers. (Džavoronková, 2022)

2.3 Student Behaviour Worldwide

Chinese authors Guo et al. studied a correlation between the use of the internet and the occurrence of sleeping disorders and suicidal behaviour among the Chinese adolescents. The purpose of that extensive study was to test the correlation between the Problematic Internet Use (PIU) and the occurrence of sleep disturbances, suicidal ideation, and suicide attempts among the Chinese adolescents, and whether the sleep disturbances mediate the correlation between PIU and the suicidal behaviour. The data were obtained from the 2017 National School-based Chinese Adolescents Health Survey. A total of 20,895 student questionnaires were qualified for analysis. The Young's Internet Addiction Test was used to assess PIU, while the level of sleep disturbances was measured using the Pittsburgh Sleep Quality Index. Multilevel logistic regression models and path models were used in analyses.

Results: Out of the total test group, 2,864 adolescents (13.7%) reported having the suicidal ideation, while 537 (2.6%) reported experiencing the suicide attempts. Following the adjustments for the control variables and the sleep disturbances, PIU was associated with an increased risk of suicidal ideation (AOR = 1.04; 95% CI = 1.03–1.04) and suicide attempts (AOR = 1.03; 95% CI = 1.02–1.04). The findings of the path models showed that the standardized indirect effects of PIU on the suicidal ideation (standardized β estimate = 0.092; 95% CI = 0.082–0.102) and on the suicide attempts (standardized β estimate = 0.082; 95% CI = 0.068–0.096) through the sleep disturbances were significant. Conversely, sleep disturbances significantly mediated the correlation between the suicidal behaviour and PIU. Discussion and conclusions: There may be a complex transactional association between PIU, sleep disturbances, and suicidal behaviour. The estimates of the mediator role of sleep disturbances provide the evidence for the current understanding of the mechanism of the correlation between PIU and suicidal behaviour. The available means of the concomitant treatment of PIU, sleep disturbances and suicidal behaviour were recommended. (Guo et al., 2018).

Lithuanian authors Lone & Kuginytė-Arlauskienė published a study titled “Manifestations of Problematic Student Behaviour in Norwegian Schools: Individual and Inclusive Education System Perspective”. They stated that in terms of problematic behaviour, several aspects should be taken into consideration. First, it is important to define the concept of problematic behaviour. However, that is not an easy task because the analyses of the manifestations of problematic behaviour often identify also certain links with emotional disorders. It is therefore almost impossible to separate the two and foresee the causal relationship. That is why it is very common that the problematic behaviour coexists with emotional issues, such as social isolation. Experts working in the Norwegian education system define the problematic behaviour as a behaviour related to learning disorders, i.e. inappropriate behaviour during lessons that causes various discipline disorders; provocative/aggressive behaviour manifested in physical and verbal attacks towards other individuals; social isolation and severe behavioural problems, such as disregard of social norms and rules, stealing, harm-causing physical attacks, constant harassing, omitting lessons and bad habits. Data used in this study was collected during the SPEED Norwegian national project (2012–2016), implemented in 95 secondary schools in 16 municipalities. The collected data was also used by one of the authors for his diploma thesis. During the study, students of 5–10 grades and their teachers were interviewed. Subsequently, the key current challenges concerning the problematic behaviour in the education system and their correlation with the social skill development were characterised. The analysed data facilitated the assessment of the current situation with an emphasis on the prevention and the individual problem solving in respect of the individual and inclusive education system, with a focus on the relationship between them. Furthermore, the obtained data was compared with the results of the previous research studies conducted in Norway, where the correlations between various forms of problematic behaviour and various social skills have already been proved. (Lone & Kuginytė-Arlauskienė, 2018).

In Finland, authors Männikkö et al., studied the problematic digital gaming behaviour and its relation to the psychological, social, and physical health of Finnish adolescents and young adults. The aim of this study was to identify problematic gaming behaviour among Finnish adolescents and young adults and evaluate its connection to a variety of psychological, social, and physical health symptoms. This cross-sectional study was conducted with a random sample of 293 respondents aged 13–24 years. Participants completed an online survey. Problematic gaming behaviour was measured using the Game Addiction Scale (GAS). Self-reports covered the health measures, such as psychological health (psychopathological symptoms, satisfaction with life), social health (preferences for social interaction), and physical health (general health, Body Mass Index [BMI], body discomfort, physical activity).

The study results showed that problematic gaming behaviour relates to psychological and health problems, namely fatigue, sleep interference, depression, and anxiety symptoms. The multiple linear regression analysis indicated that the amount of weekly gaming, depression and a preference for online social interaction predicted increased problematic gaming symptoms. This research emphasised that problematic gaming behaviour had a strong negative correlation to a variety of subjective health outcomes. (Männikkö et al., 2015)

3 Educational Counsellors Role

According to Act No. 138/2019 Coll., Section 38, an educational counsellor provides educational counselling through informative, coordinating, consulting, methodical and other related activities and intermediates professional therapeutic and educational activities.

Educational counsellor is a pedagogical employee of a school appointed by the school principal under the appointment letter. The term of this office is not limited in time and depends on the quality of the work performed. At present, the emphasis is being put on the prevention of negative effects and the mental development of students.

Educational counselling is provided to children, their legal representatives and school employees in schools and educational establishments through the activities performed by educational counsellors. Where necessary, educational counsellors intermediate the pedagogical, psychological, social, psychotherapeutic, re-educational and other services for children and their legal representatives and coordinate such services in cooperation with class teachers. The purpose of educational counselling is to provide counselling when addressing the personality-related, educational, professional, and social needs of children, as well as the career counselling. Educational counsellors closely cooperate with a school psychologist, special education teacher and experts from the counselling institutions.

3.1 Legislation Regarding Educational Counsellors

The position and tasks of educational counsellors are defined in the related legislation, such as the laws of the National Council of the Slovak Republic, decrees of the Ministry of Education

of the Slovak Republic, and decrees of the Government of the Slovak Republic. The relevant laws specify the characteristics, occupational duties and required qualification of an educational counsellor for performing not only the pedagogical, but also expert activities. The laws also specify the further education, career positions, evaluation, and care of pedagogic employees.

According to Act No. 245/2008 Coll. on Education and Training (School Act) and on Amendments and Supplementation to Certain Acts, Section 145a, effective since 1 September 2023, educational counsellors in cooperation with their support teams implement 21 support actions, which are characterised as the actions implemented by a school or an educational establishment that are required for a child or student to be able to fully engage in the education and training process and enhance their knowledge and develop their skills and capabilities. The support actions include the following:

- 1) Provision of education and training based on the determined objectives, methods, forms and approaches applied in the education and training process; it is provided by schools, educational establishments or special education facilities.
- 2) Provision of education and training based on the determined curricula and the evaluation of the achievements accomplished by children or students in the education and training process; this is provided by schools, educational establishments, or special education facilities.
- 3) Activities aimed at the development of physical capabilities, sensory functions, communication abilities, cognitive ability, social communication abilities, emotionality and self-help skills; this is provided by nursery schools, nursery schools for children with special educational needs, elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs or special education facilities.
- 4) Activities supporting the achievement of the capacity to attend a school; this is provided by nursery schools, nursery schools for children with special educational needs, counselling and prevention facilities or therapeutic and educational sanatoria.
- 5) Courses for learning the language used in the teaching process or other support for learning the language used in a particular school; this is provided by nursery schools, nursery schools for children with special educational needs, elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs, except for bilingual schools or special education facilities.
- 6) Tutoring or targeted learning aimed at achieving the highest possible level of the individual cognitive potential of children or students; this is provided by nursery schools, nursery schools for children with special educational needs, elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs or special education facilities.

- 7) Improving the conditions for the education and training of students from socially disadvantaged backgrounds; this is provided by schools or educational establishments.
- 8) Education in a particular school subject or education area in higher grades; this is provided by elementary schools, elementary schools for talented children, secondary schools, or secondary schools for talented students.
- 9) Providing special forms of communication for children/students with disabilities to communicate with a school or an educational establishment; this is provided by schools or educational establishments.
- 10) Activities supporting social inclusion; this is provided by schools or educational establishments.
- 11) Activities supporting the prevention of cases where children terminate their school attendance in a grade lower than the last grade of an elementary or secondary school; this is provided by elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs, counselling and prevention centres or special education facilities.
- 12) Specialised career counselling: this is provided by elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs or counselling and prevention centres.
- 13) Provision of services of a pedagogic assistant in the classroom; this is provided by nursery schools, nursery schools for children with special educational needs, elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs or special education facilities.
- 14) Provision of healthcare; this is provided by nursery schools, nursery schools for children with special educational needs, elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs or special education facilities.
- 15) Provision of self-help actions according to a special regulation during the education and training process; this is provided by schools or educational establishments.
- 16) Provision of special educational publications and compensatory aids; this is provided by nursery schools, nursery schools for children with special educational needs, elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs or special education facilities.
- 17) Adjustment of the school premises aimed at supporting the perception capacities and developing skills; this is provided by schools or special education facilities.
- 18) Elimination of physical barriers in schools or educational establishments, as well as organisational barriers in the education and training process; this is provided by schools or educational establishments.

- 19) Provision of dietetic food; this is provided by school catering facilities.
- 20) Prevention aimed at promoting physical and mental health and the prevention of high-risk behaviour; this is provided by schools or educational establishments.
- 21) Crisis intervention: this is provided by nursery schools, nursery schools for children with special educational needs, elementary schools, elementary schools for students with special educational needs, secondary schools, secondary schools for students with special educational needs, counselling and prevention centres or special education facilities. (Act No. 245/2008 Coll. on Education and Training (School Act) and on Amendments and Supplementation to Certain Acts, Section 145a, 2023)

3.2 Educational Counsellor's Duties

An educational counsellor performs duties towards the individual entities related to surveys, identification, evaluation, diagnostics, screening, consulting, methodology, communication, raising awareness and prevention, conceptual planning, organising and administration. Educational counsellors perform the educational counselling tasks, usually in cooperation with class teachers, through the monitoring of students who have problems with education, training, and development of their personality. They also inform and help students and their parents (legal representatives) when selecting a study, an occupation, or a job position. They help class teachers when working with intellectually gifted and talented students, as well as students who are socially disadvantaged, who have special educational and training needs, and students who enrol in secondary schools. They also cooperate with experts in the provision of social counselling and organise and participate in the implementation of preventive activities for students. They also coordinate the educational process in the school, cooperate with the school management, parents, teachers, class teachers and with a coordinator of the prevention of socially pathological issues. At pedagogical meetings, they provide information on the educational and training activities and the measures that are required to solve the problems. They provide consulting and assist to students and actively participate in the meetings, seminars, and trainings for educational counsellors. Together with pedagogical and expert employees, they may assist with the preparation of educational recommendations that ensure a positive atmosphere in schools.

Educational counsellor's duties towards students. Educational counsellors strive to facilitate that the students objectively discover their own personalities and have an opportunity to obtain high-quality information for the purpose of harmonising their ambitions with the current societal needs. In cooperation with class teachers, educational counsellors monitor changes in the behaviour of students. Subsequently, they monitor the process of adaptation of first graders and solve the potential issues in cooperation with other teachers and parents. They pay special attention to gifted and talented students and students from the socially disadvantaged backgrounds. They raise awareness among students of the issues related to discrimination, racism, xenophobia, anti-Semitism, as well as other manifestations of

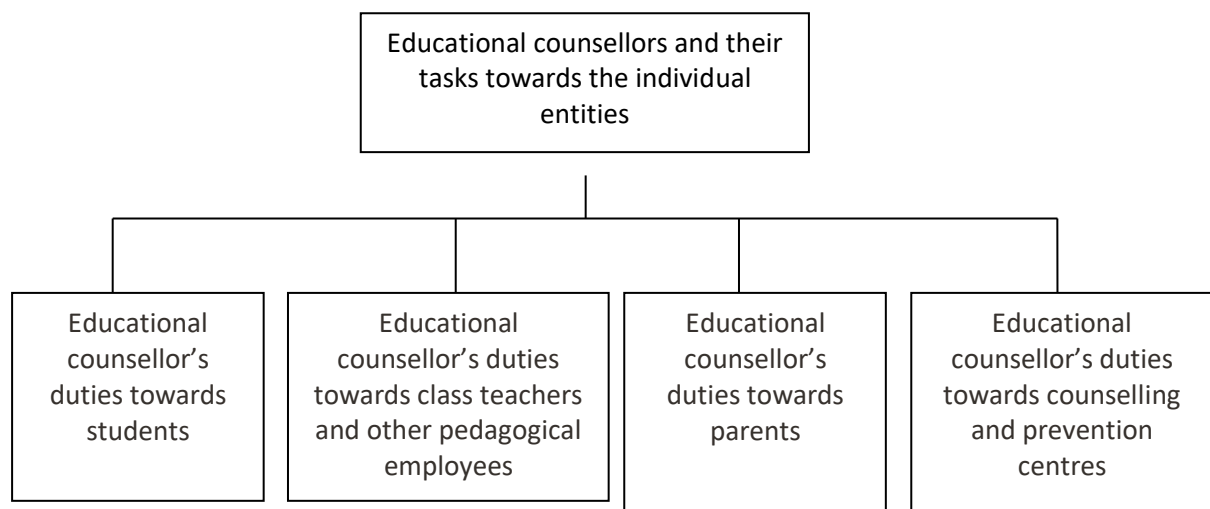
intolerance. They provide the latest information to students of the last grade, including the reviews of the available studies at universities, post-secondary, and further education studies. They pay attention to the education of students about respecting human rights in their classrooms and schools with the aim of promoting the value of a human being. Finally, they provide methodical assistance to students who fill out the application forms for university studies.

Educational counsellor’s duties towards class teachers and other pedagogical employees.

They provide consulting regarding conflicts or other extraordinary situations in classrooms, arrange the cooperation with the centres for pedagogical and psychological counselling and prevention and the police. They continuously monitor absenting students and cooperate with class teachers. They help in the preparation of awareness-raising discussions with students.

Educational counsellor’s duties towards parents. They intermediate pedagogical, psychological, social, psychotherapeutic, and re-educational services when requested by parents. They inform parents on the preventive activities organised in the school and on the available means of assistance to children in danger.

Educational counsellor’s duties towards counselling and prevention centres. In cooperation with class teachers, they prepare documents for the specialised psychological and special pedagogical examinations. As required, they consult the findings and recommendations from those examinations with experts from the counselling and prevention centres and participate in meetings with such experts.



Picture 1 Educational counsellors and their tasks towards the individual entities
(Source: authors)

4 Conclusion

Problematic behaviour and behavioural disorders in children and young people should be perceived systematically, with close connections to their age, life situation, family background and current health. In everyday life, there are situations in which all of us encounter various forms of improper behaviour, such as aggression, disturbances in lessons and bullying, as well as other, more serious types of behaviour. Problematic behaviour reflects the times we live in. Our society creates the conditions for positive, as well as negative phenomena, which may be manifested in the behaviour of children who are beginning to attend schools. In their families, children often lack a positive role model in their parents, and such families may lack love and financial security. In modern hectic and difficult times, parents also have difficulties in managing the upbringing of their children. That is why these children seek role models in their peer groups or on social media, as a replacement for the absent role models in their families. The absent parenting role is therefore transferred into schools, where this role is assumed by teachers, educational counsellors, psychologists, and special teachers.

The decline of our society has brought about increasing problems, as well as certain toleration in respect of the misuse of addictive substances – for instance, drug vending machines are now available, even to the minors. Physical activity has been replaced with time spent on the internet and in the virtual reality. All the aforesaid factors result not only in problems with behaviour, but also in numerous, increasingly prevalent health issues. It is therefore our responsibility to be able to recognise these serious problems and address them, because in our common future we will encounter such inappropriate and problematic behaviours more and more frequently.

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Synergy of Positive Emotional Stimuli and Education Technologies in JobLab English Speaking Development for Graduates

Antónia Bugárová¹, Oľga Kissová², Lucia Krištofiaková³

DOI: <https://doi.org/10.53349/resource.2024.is1.a1239>

Abstract

This study delves into the effectiveness of integrating the PERMA model, emphasising the synergy of positive emotional stimuli and education technologies satisfying digital natives daily within JobLab's framework for FLA (Foreign Language Acquisition) development among graduate students. The research methodology combined qualitative and quantitative data. With a focus on nurturing holistic well-being and language proficiency, this research involves forty-six students divided into an experimental group (N=23) with an innovative approach and a control group (N=23) following traditional teaching methods. Pre/post-observations and student self-assessment questionnaires FLCAS (Foreign Language Classroom Anxiety Scale) were utilised to assess the impact of the intervention. Statistical analysis using established software revealed notable improvements in English-speaking proficiency among the experimental group, emphasising the significance of the PERMA model's integration in JobLab. Results indicated improved professional English language learning performance for the experimental group with the positive emotional stimuli and technology integration approach, highlighting the potential for cultivating proficient communicators among graduates.

Keywords: JobLab, FLCAS, Perma model, Positive emotional stimuli, Educational Technologies

1 JobLab

The Job Lab framework, pioneered by the University of Zilina, Slovakia, equips students for the global market by prioritising student-centred learning in foreign language acquisition for

¹ University Zilina, Univerzitná 8215/1, 010 26 Žilina, Slovakia.

E-mail: antonia.bugarova@uniza.sk

² DTI University, Ul. Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovakia.

E-mail: kissova@dti.sk

³DTI University, Ul. Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovakia.

E-mail: kristofiakova@dti.sk

graduates. We focus on enhancing learners' language proficiency, teamwork, and communication skills by teaching English, German, and Russian languages. Teaching English is the mainstream based on ESP (English for Specific Purposes). This approach tailors English language teaching to meet learners' specific needs based on their field of study, contexts, and goals, such as business and academic

English, mainly presentation skills development. It presents a student-centred modern trend in foreign languages teaching/ learning English as the global language for business and communication to express ideas, persuade others, and take part in meaningful discussions.

1.1 Foreign Language Anxiety

Language anxiety is inversely proportional to language acquisition: the less anxious, the more acquisition, or the more anxious, the less acquisition. FLA (Foreign Language Anxiety) negatively impacts foreign language learning. It creates a mental block against learning a foreign language, triggers negative emotions, blocks memory, and creates a subjective feeling of tension, nervousness, and worry associated with the arousal of the autonomic nervous system.

The study employs the Foreign Language Classroom Anxiety Scale questionnaire (FLCAS) before and after the intervention. The questionnaire scaling is an anxiety and self-assessment instrument that measures FLA (Foreign Language Anxiety). The FLCAS, consisting of 33 items, is designed to measure FLCAS on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to assess respondents' anxiety in the language classroom, ascertaining whether respondents experience anxiety in response to various situations specific to foreign language learning.

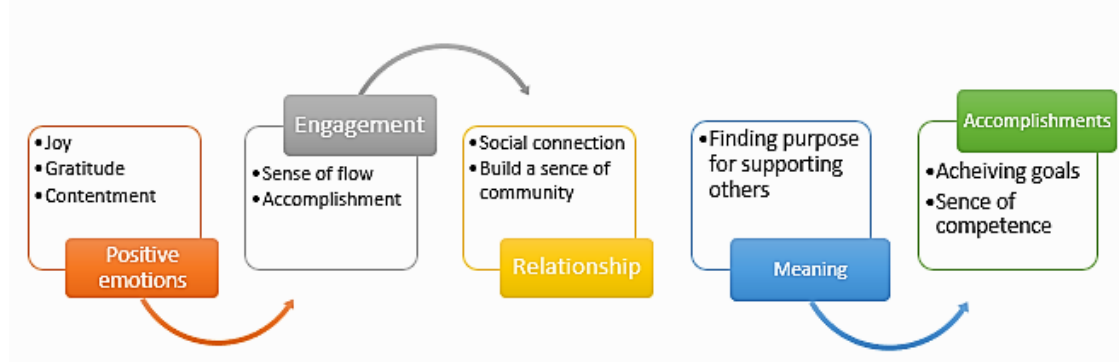
According to author Horwitz, the FLCAS - Foreign Language Classroom Anxiety Scale aims to "assess the degree of anxiety evidenced by negative performance expectations and social comparisons, psychological symptoms, and avoidant behaviours" (Horwitz et al., 1986, p. 559).

Horwitz et al. defined the most negative fear of negative evaluation as a category of anxiety associated with foreign language learning as "the fear of evaluation by others that accompanies the avoidance of evaluative situations and the expectation that others will evaluate oneself negatively" (1986, p. 128). It is known that the discomfort, stress and pressure of practising English out of a stress-free environment are usually triggered by a lack of linguistic ability and fear of making mistakes, perceiving them as threatening factors to one's identity.

1.2 PERMA Model

The model was implemented to use positive psychology in the context of English language teaching. The PERMA model introduced by Martin Seligman means five essential elements for

well-being and happiness that we employ in foreign language acquisition in the JobLab environment. The acronym PERMA stands for Positive Emotions, Engagement, Relationships, Meaning, and Accomplishment in a student-centred and stress-free educational approach.



Picture 1: PERMA model implementing positive emotional stimuli in the JobLab (Source: authors)

Positive emotional stimuli are based on three factors: the first represents the teacher-student relationship in a stress-free educational environment; the second implement effective supportive strategies (modelling, layering, scaffolding, favourable error treatment); and the last adopt tools (educational technologies) in teaching/learning, increasing interest and motivation. According to Kralova and Kamenicka, emotional stimuli persist longer in memory than in neutral memories. They are recalled with greater accuracy and immediacy, which increases declarative word knowledge and enjoyment of foreign language (Kralova & Kamenicka, 2019).

We know from practice that modern activating learning support strategies using learner-centredness, knowledge of the learner's learning style (visual, auditory, verbal and motor), and understanding of the learners' professional/vocational background not only leads to a compelling selection of materials but is a suitable approach to eliminate language anxiety (breathing exercises, visualisation). The main factor is the teacher, whose healthy relationship with learners is also very significant. We can apply different methods to design the class in a more relaxed and diversified way to arouse the students' interest, ease their tension, and help them have the enthusiasm to learn the language. Teachers' supportive strategies are modelling, layering, and scaffolding.

1.3 Positive Error Treatment

Students make mistakes and then learn a lesson from the mistakes. Making mistakes is a natural process for language learning, so the teacher should appropriately correct them, correct only selected errors, preferably just those that interfere with learning and use self-correction of the students. The process of making mistakes and restoring them helps you to succeed in second language learning. Feelings are the emotions that make us human. We must remember that we are all humans and must express our feelings in a way that is within the parameters of correct expression. When we ignore or suppress our feelings, they can lead to

physical and emotional problems. It is helpful if educators know the emotional journey of our learners. In the JobLab approach, we not only strive to acquire language and communication skills in English but also consider the goals of positive psychology.

According to Seligman (2017), the objective is to build life's best qualities and discover, understand, and support the factors that enable people and society to flourish and thrive.

Mares (2002) defines the goal of positive psychology as nurturing healthy psychological development, quality social life, personal growth, moving toward wisdom, and leading a meaningful life. That is, to know oneself, to use one's potential, and to change dysfunctional ways and decisions, thus showing a happier and more satisfying life in contemporary society.

2 Educational technologies (Edu Tech)

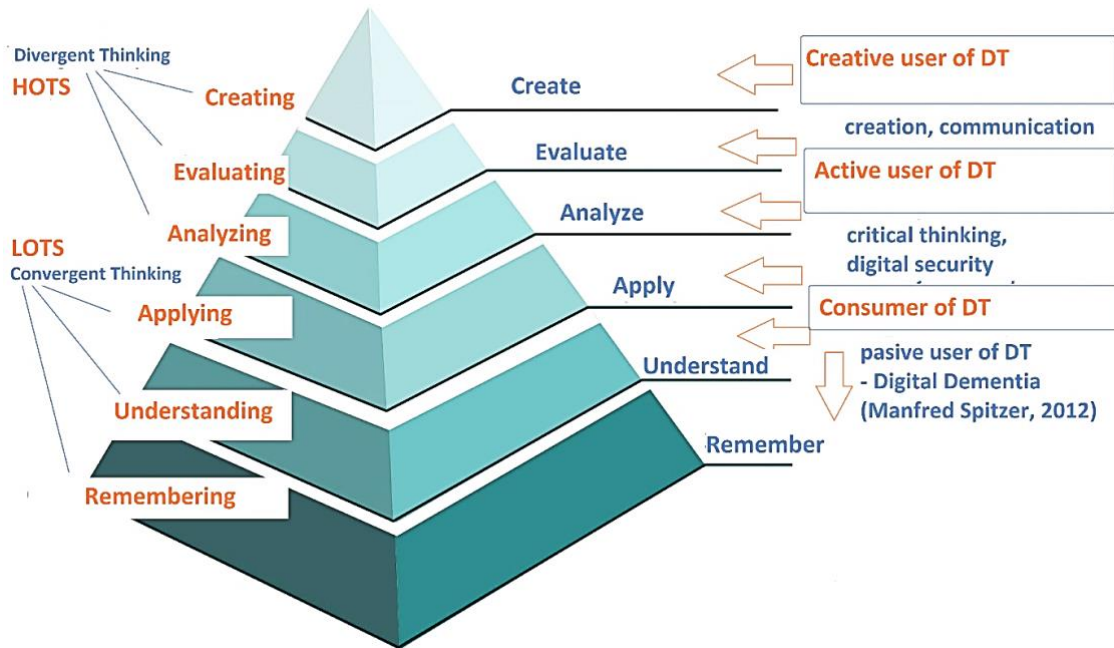
Educational technologies support student-centred learning, increasing efficiency and interest, inspiring and providing effective feedback. However, technology should be a tool, not a means of education. Nowadays, the teacher is permanently exposed to the scrutiny and competition of the whole (online) world, whether he knows it or not. We live in a society of networking, online communication, and collaboration, which operates like this: Know your role, take responsibility for yourself, and convince others what you are good at. Digital technologies are now an essential part of students' lifestyles. From a positive psychology perspective, we can effectively harness their potential as a positive emotional stimulus in language learning.

Seligman and Peterson define wisdom and knowledge as virtues. Through this educational tool, we foster students' creativity, curiosity, open-mindedness, love of learning, and detachment, emphasising wisdom's significance within this framework. The remaining virtues, which contribute to the concept of a "good" character, include courage, humanity, moderation, and transcendence. (Seligman & Peterson, 2004)

The transformation of education of the future requires the development of creative digital literacy, known as digital creativity in teacher preparation and teaching, which is an essential factor for self-development and advancement in society (Pokrivčáková et al., 2009).

Creative digital literacy is understood as a particular set of digital knowledge, skills, and abilities that go beyond the scope of individual disciplines, thus having an interdisciplinary character involving continuous learning and the effective use of technology.

Integrating digital literacy and the revised Bloom's Taxonomy in picture 2 exemplifies technology's transformative potential in tertiary education. The visual representation underscores the dynamic relationship between these concepts, highlighting the power of digital literacy to elevate cognitive skills across different levels of Bloom's Taxonomy described in HOTS (higher order thinking skills) and LOTS (lower order thinking skills) shown in the left orange part of the pyramid. Brestenska states that the students using digital technologies(DT) in the process of learning languages can act as consumers, active users, or creative users of digital technologies (Brestenska, 2022).



Picture 2: Digital literacy (creativity) and revised Bloom's taxonomy
(Source: authors based on Brestenska et al., 2020)

If teachers and students use digital technologies without added value, they can develop lower cognitive thinking skills (LOTS) based on knowledge acquisition, understanding and application. In that case, they remain at the level of digital technology consumers. As Spitzer points out, cognitive decline can occur at this level, which can eventually lead to digital dementia. (Spitzer, 2012)

If participants in the learning process mutually use the added value of digital technologies, they can develop higher cognitive skills (HOTS) (analysis-synthesis, evaluation, creativity). In that case, they become active and creative users of digital technologies who think, evaluate, and create independently.

JobLab's teaching approach focuses on students' active use of the foreign language, which supports the introduction of activating teaching methods (discussions, presentations, projects, collaborative work, role-playing, brainstorming, problem-solving learning, and creative assignments) using digital tools and modern technologies.

Table 1 shows the required knowledge and skills set in the University Zilina Information Sheets for Foreign Language in Engineering Studies with the implemented digital tools and application in the JobLab approach to teaching English and German in the ESP environment.

Table 1: Required communication skills, competencies and modern technologies apps used in JobLab
(Source: authors)

Area of knowledge, skills, competences according to the UNIZA information sheet	Digital tools, applications, and platforms within JobLab
Presentation skills, working with industry information, interactive implementation of soft skills (time management, teamwork)	MS Office (MS et al.), Youtube, Gamma, SlidesAI, SlidesGO, Decktopus
Professional knowledge, working with information from the field, practising formal and professional verbal and writing style, sub-assignments	Grammarly, WordHippo, German Corrector, LanguageTool, Writefull; Text to Voice Converter; online translators, Google, online databases
Lexical-grammatical competence in a professional foreign language, professional terminology, reading and listening comprehension, creating added value, critical and creative thinking development	Socrative; MS Teams, LearningApps, WordHippo, Educaplay, Virtualspeech, Live worksheets, Memrise, Quizlet, Kahoot, KialoEdu; MindMeister, Mindmaps, Meetingswords, Tarsia, Actionbound, Web2.0 tools
Communication skills in a professional language, professional knowledge, lexical-grammatical competence	JibLab e-portfolio, MS Teams, Moodle, Socrative, Blackboard, Google Disk, Google Drive, Zoom, Google Meet, Mindmaps, MS Office

3 Research

3.1 Research instruments

Research instruments are based on combining qualitative and quantitative data. FLCAS (33 items) scales were in 5-Likert-scale format with five responses of Strongly Agree (SA = 5), Agree (A = 4), No Comment (NC = 3), Disagree (D = 2), and Strongly Disagree (SD = 1). Furthermore, in 9 out of the 33 anxiety items of FLCAS, which statements were negatively worded, for example, item 2, “In English class, I do not worry about making mistakes”, responses were reversed and recorded. The effect of anxiety on language learning is two-fold: positive and negative. Horwitz et al. divided the 33-item FLCAS into three categories: communication apprehension, test anxiety, and fear of negative evaluation, the three general sources of anxiety (Horwitz et al., 1986). Anxiety might force students with higher self-esteem and strong motivation to develop a more positive attitude and favourable motivational intensity and achieve better outcomes and language learning achievement.

In the Foreign Language Classroom Anxiety Scale (FLCAS), the three kinds of anxiety were involved and elaborated in our research.

- The fear of Negative Evaluation (anxiety items 2, 7, 13, 19, 23, 31, 33) (M = 3.13, SD = 0.44).
- Communication Apprehension (anxiety items 1, 4, 9, 14, 15, 18, 24, 27, 29, 30, 32) (M = 3.12, SD = 0.43).

- Test Anxiety (anxiety items 3, 5, 6, 8, 10, 11, 12, 16, 17, 20, 21, 22, 25, 26, 28) (M = 3.05, SD = 0.41).

Students were more anxious to “keep thinking that other students are better at English than I am” (item 7) (M = 3.38, SD = .91), “feel overwhelmed by the number of rules to learn to speak English” (item 30) (M = 3.30, SD = .86), “know that I am going to be called on in English class” (item 3) (M = 3.29, SD = 0.91), “find myself thinking about things that have nothing to do with the course” (item 6) (M = 3.26, SD = 0.86), and “always feel that the other students speak English better than I do” (item 23) (M = 3.26, SD = 0.86).

The Cronbach’s 0.899 regarding the whole questionnaire showed internal consistency reliability, indicating that the research instruments of the study were quite reliable and valid for our research.

3.2 Participants

The test sample participating in the experiment consists of 46 students at the University of Žilina (1st year engineering studies, major in Economics and Management). Before the investigation, the students were divided into two homogeneous groups: experimental (n=23) and control (n=23). The student’s English language level in both groups was B2 by the EU CERR (CERR, 2017).

Levine’s T-test (analysis of variance) was used to detect differences between the groups, confirming the homogeneity of the distribution of the groups before the intervention.

Table 2: Homogeneity of the experimental and control groups before the intervention based on comparison of groups before the intervention (Source: authors)

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
komp_basic	Equal variances assumed	.260	.613	.512	48	.611	.88000	1,71833	-2,57494	4,33494
	Equal variances not assumed			.512	47,576	.611	.88000	1,71833	-2,57574	4,33574

3.3 Findings

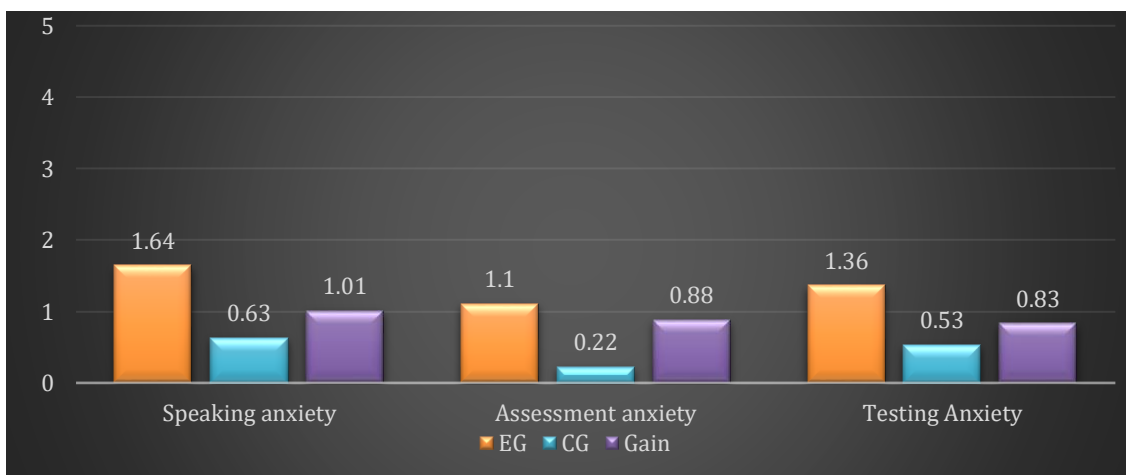
This study uses dynamics of language development, particularly in the context of the JobLab approach based on the PERMA model, implementing FLCAS to measure the level of increasing/decreasing stress in foreign language learning to train better formal professional skills. Focused on integrating innovative methodologies within the JobLab framework, the research emphasises the significant role of language development in fostering effective professional communication and enhancing positive results regarding speaking anxiety.

The reduction of speaking anxiety was most pronounced with a gain of 1.42 (EG) against an increase of 0.59 (CG) in favour of the experimental group (gain +0.83). Verbal communication in the professional English language (speaking) is the essential and most critical component of presentation skills as it has a robust negative effect on language anxiety. The reduction in language anxiety in the assessment was manifested with a gain of 0.88 (Exp) against a gain of 0.60 (Con) in favour of Exp. (gain +0.28). Appropriate application of assessment criteria (self-assessment, peer-rating, rubrics, video recording of performance) can reduce language anxiety. In addition, the application of adaptive computer testing, through video recording and technology, will increase objectivity and reduce the stress of the assessment.

The reduction of language anxiety in testing was manifested with a gain of 0.83 (Exp) versus 0.43 (CG) in favour of EG. (gain +0.50). The stress of testing knowledge is lower when we use supportive learning strategies using learner-centeredness and knowledge of the learner's learning. The significance of coping with language anxiety in the English language lies in the professional and personal use of presentation skills, job interviews, public speaking, and other communication activities towards the full employment of our graduate students.

The findings underscore the effectiveness of the JobLab approach, the PERMA model based on a positive approach, and the FLCAS questionnaire in mitigating language anxiety, enhancing language learning, and preparing students for successful communication in professional contexts for the global business world.

Graph 1 shows the comparison of the control group with the experimental group as a positive reduction in the intensity of anxiety in all three parameters of language anxiety (speaking, assessment, and testing) studied after the intervention.



Graph 1: Comparison of lowering speaking anxiety results of experimental and control groups based on FLCAS JobLab (Source: authors)

The average gain for EG and CG was calculated by finding the average difference in scores that they have reached between pre-tests before and post-tests after experimental treatment for a group of students, indicating the overall improvement in their performance (the sum of individual gains was divided by the number of participants).

3.4 Questionnaires: Open-ended questions

In addition to our quantitative findings, the open-ended questions in the questionnaires yielded rich insights into several key satisfaction issues. These responses shed light on specific aspects of the JobLab approach appreciated by students compared to the traditional approach. Here is a detailed exploration of the categories identified:

Increase intrinsic motivation and satisfaction,

enhance confidence in oral speaking, and help better prepare for conversation, negotiations, problem-solving, and decision-making. Many students expressed a notable increase in intrinsic motivation and overall satisfaction with the JobLab approach. The hands-on and interactive nature of the approach, which incorporates real-life scenarios, positive emotional stimuli, and practical applications, resonated positively with learners. This finding aligns with our quantitative data, reinforcing that a learner-centric, experiential approach enhances motivation and satisfaction.

Educational digital technologies

A noteworthy observation from open-ended responses was the positive impact of educational digital technologies (Edu Tech) on students' interest in studying. Many students, particularly millennials accustomed to digital environments, preferred technology-enhanced learning. Interactions with Edu technologies were perceived as engaging and aligned with their intuitive use of digital tools. This finding complements our quantitative data, emphasising the role of technology in fostering engagement and interest.

Preparedness for Real-Life Problem-Solving using the JobLab approach

The open-ended responses consistently indicated that exposure to educational digital technologies within the JobLab approach made students feel more prepared for real-life problem-solving. Integrating authentic materials and technology-driven learning experiences equipped students with practical skills applicable in professional settings. The open-ended questionnaire responses provide valuable qualitative insights that complement our quantitative findings. The students' appreciation for the JobLab approach's impact on intrinsic motivation, the positive influence of educational digital technologies, and preparation for diverse communication scenarios underscores the effectiveness of this innovative methodology.

Limitations

While our study provides valuable insights into the effects of our intervention, it is crucial to acknowledge certain limitations that may impact the generalizability and depth of our

findings. Our study has limitations: the small sample size and the time of the 13-week-long experiment do not address the learner's personality traits.

Conclusions

In conclusion, the findings of this study underscore the effectiveness of the JobLab approach, grounded in the PERMA model, in mitigating language anxiety and fostering language development among graduate students through digital tools. This study showed significant learning gain differences mostly in favour of the experimental group because of positive emotional stimuli and digital education dynamics of language development focused on formal professional English speaking.

The noteworthy reduction in speaking anxiety, as evidenced by a substantial gain of 1.42 in the experimental group compared to a modest increase of 0.59 in the control group, highlights the pivotal role of addressing language anxiety in enhancing verbal communication skills. This is particularly crucial for developing presentation skills and recognising the robust negative influence of language anxiety on spoken language proficiency.

The quantitative findings reveal student satisfaction with the JobLab approach compared to the traditional approach. The categories of increased intrinsic motivation and the positive impact of Edu tech tools on interest and preparation for real-life problem-solving highlight the holistic benefits of this innovative language development approach for the successful transition of graduate students into professional settings.

Acknowledgements

This research and paper publishing was supported by the financial support of the Slovak National Grant Agency KEGA under Projects: KEGA 007ŽU-4/2023 Job Labs Foreign language training for global market needs at UNIZA and KEGA 002VŠDTI-4/2022 Creation of an interactive support tool for beginning teachers of upper secondary education in Slovakia.

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A creative solution to simple experiments in the subject of technology within the STEM concept

Jana Depešová¹

DOI: <https://doi.org/10.53349/resource.2024.is1.a1240>

Abstract

Teaching with the STEM concept represents education that uses the connection of science, technology, mathematics, engineering, and the natural sciences. The “STEMkey” project, whose solutions are members of the KTIT PF UKF in Nitra, contributes to modernising STEM teacher education in Europe and strengthens teachers' professional development. It supports the development of better quality and more attractive STEM courses for students motivated to teach about individual STEM subjects and how they can use them to solve problems arising from simple experiments. The article describes an activity prepared for the summer school in Lisbon by researchers from Nitra. In a prepared task, it was necessary to solve the pumping of polluted water, controlled by the BBC microcontroller, into a sand filter. Students and future teachers from several European universities participated in the summer school. The prepared activities aimed at developing student teachers' abilities to apply the concept of STEM education in the educational process.

Keywords: STEM, Summer school, Technical Education, Teacher Training, International project

1 Introduction

One of the goals of education at primary and secondary schools is to prepare students for practical and real life so that every graduate has the same opportunity to join the work process in the current developing information society, knowledge economy, and globalisation. Currently, the prevailing method of teaching and evaluating students by classification level requires implementing research education elements and new evaluation procedures into the teaching process (Depešová, J. et al., 2010).

¹ Constantine the Philosopher University in Nitra, Dražovská cesta 4, 949 74 Nitra.

E-mail: jdepesova@ukf.sk

Based on the decision of the Ministry of Education and Culture of the Slovak Republic, from šk. in 2015/2016, technical education began to be implemented from the 5th year of primary school (ZŠ) by the updated State Education Program (iŠVP) according to the updated Educational Standard (iVŠ) subject of technology. The subject of technology in lower secondary education has its fixed, specific and irreplaceable place in the system of teaching subjects, which cannot be replaced by any other subject (ŠPÚ, 2015), (Ďuriš et al., 2023). The document Innovative State Educational Program for the Subject of Technology states that technology as a subject must be based not only on the acquisition of theoretical knowledge but, above all, on practical activity. Its content focuses specifically on skills and habits for the students to use in their future lives and society. It is based on the creative thought participation and cooperation of students. Primary education enriches with an essential component by laying the foundations in the field of technology, which are necessary for further study and application of a person in real life. Pupils learn to plan, organise and evaluate work independently and in groups. With its content, the technical subject continuously provides students with important information. It helps them make responsible decisions about their next professional focus and decisions in life (Act 245/2008 Coll.).

With the idea of fulfilling education goals in technology, several projects were developed and are currently being solved. The paper presents some solved problems in the ERASMUS+ KA2 project STEMkey Teaching standard STEM topics with a key competence approach, grant no. 2020-I-DE01.KA203.005671 and KEGA 006UMB-4/2022 Implement a research-oriented education model in the subject of technology in lower secondary education, focusing on the cognitive area. Both projects jointly focus on the creative solution of simple experiments in technology. The Kega project is focused on designing and verifying a research-oriented model of student education in technology in lower secondary education. The project's main goal reflects the long-term current needs of students in the subject of technology, which, despite the innovative content of the curriculum in the Educational Standard of the subject of technology, has not yet been met. The teaching subject of technology must be based not only on the knowledge of theoretical knowledge but, above all, on practical activity and the creative thought participation and cooperation of the pupils. This requires the active participation of students in the teaching process, which can be achieved, for example, using research-oriented teaching. Another need is to carry out activities of an experimental nature using available and inexpensive aids (Čapek, R., 2021).

The proposed activities of an experimental nature solved within the projects are methodically processed with the application of formative assessment of students (self-evaluation sheets for students) with a focus on understanding and specific transfer of the curriculum in the cognitive area. The concrete outcome of the experiment with the application of the STEM concept was an activity implemented as part of the international summer school. The STEMkey summer school, which took place in Lisbon, Portugal, from 26/06/2023 to 30/06/2023, offered future teachers the opportunity to meet experts from various institutions, participate in interesting workshops and excursions that helped them understand

how to integrate knowledge, skills and attitudes into teaching and how to motivate your future students to think responsibly and critically. One of the goals of the summer school organized as part of the STEMky project was to support the EU initiative regarding key competencies in STEM education. The project develops learning modules that cover all STEM disciplines and show their connections and applications in different contexts. These modules will be used in university programs and training for future teachers to help them become "key competent in STEM."

The starting point for the activity proposed by KTIT PF UKF in Nitra was that water resources are under tremendous pressure in many parts of Europe, and the situation is constantly worsening. Agriculture, electricity generation, industry, and drinking water supply to households are equally important, and all are fighting for this limited resource. With climate change, water supplies are becoming less predictable. Therefore, Europe must use water more efficiently to benefit all its inhabitants.

In Slovakia, we still have enough drinking water sources, but it is necessary to conserve water. We can use rainwater (e.g., for watering and household maintenance) or obtain drinking water through filtration.

The activity that the students had to deal with was focused on the proposal to collect rainwater from the roof of the building, which needs to be cleaned using a filter. The student's task was to design a system for cleaning and pumping water from catchment containers to the water plant in the house's attic or cottages without access to sufficient drinking water.

2 Activity proposal for 8th graders with a STEM concept

The task: Create a system for pumping and purifying water using the micro bit Smart Home kit

Representation of elementary school subjects in the STEM concept

Science: Biology, Physics, Chemistry, and Ecology

Technology: Informatics, technique

Economy: Technique

Mathematics: Mathematics

Technical equipment: micro: bit, Smart home kit



Picture 1: Microbit

(Source: available <https://www.alza.sk/bbc-microbit-kit-pre-inteligentnu-domacnost-d5655518.htm?layoutAutoChange=1> <https://www.elec freaks.com/micro-bit-smart-home-kit.html>)

1.1 2.1 How Does Water Distribution Work?

Household water that can be used can be:

- drinking water: it is intended for drinking and cooking
- service water is intended for irrigation, washing clothes, etc.
- Wastewater: It arises from drinking water or service water, washing dishes, washing clothes, flushing the toilet, rainwater, etc.

Water distribution works mainly by self-fall in the following way:

Water is distributed to the household from the water source, a well or a tank. Meanwhile, the next steps happened to the water:

1. Water is collected - a well, a water tank, in the case of a wooden house, only a well and rainwater are available.



2. The water is purified; the purification can be mechanical using a sand filter or chemical in water plants. In our case, a mechanical water filtering system will be used in the cottage.



3. Reservoir. It collects potable water after treatment for further distribution.



4. The water distribution in the home itself. According to the picture below, it is a technical system of water distribution to individual parts of the building.



- Water in the building is distributed using a system of pipes. There is usually a main valve, a water meter for measuring water consumption, or a filter at the entrance. Furthermore, it is distributed to individual apartments or rooms with a sink, toilet, or water sink or directly to washing machines or dishwashers.

Activities

- Arrange the water distribution system in the home according to the associated *images*.



- Find out the content of chemical substances in public water in your area.
- The technical standard prescribes the waterfall to a value of 2%. Calculate at what depth and height the well must be placed to collect water for the cottage if it is planned at 100 distances from the dwelling.
- Discover at what height the rainwater collection tank must be placed so that the pressure in the pipeline is 0.4 kPa.

Activity 1

According to the attached pictures and theory, determine the water distribution system.

Time 5 minutes

Activity 2

They can find out the chemical composition of the water in the specified location from Internet sources. The location of the teacher training institution conditions the location of the water purity. They detect chemical substances in water that are harmless to human health, as well as chemical substances and their limit values that are dangerous for humans. They will discover possible ways of treating water to be safe for humans. The determined values are

recorded and evaluated in groups. The group of cooperating students must be a maximum of 3.

Time: 30 minutes.

Activity 3 and 4

Based on the direct ratio, they calculate the necessary data and design the essential parts of the water distribution from the well to the cottage and from the rainwater tank for the house. In the essential parts of the water supply and the water system, individual technical elements of the water system must be included, such as the main valve, water meter for each branch separately, rainwater filtration, the length of the water pipe, what material the water pipe must be made of, what the diameter of the water pipes should be, in what way they will connect.

Time: 30 minutes

What will students learn?

Teacher students will acquire the following competencies:

They will understand the water distribution system in the home and the technology of its construction.

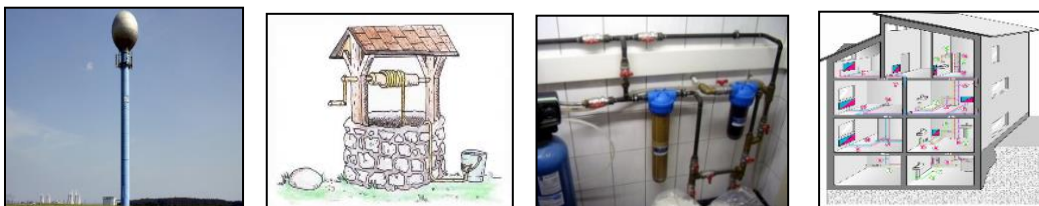
They can calculate and compare the waterfall according to technical standards.

They will be able to describe and understand the composition of water in terms of health and safety.

Approach

Activity 1

Arrange the water distribution system in the home according to the associated images:



According to the attached pictures, students will determine the water distribution system.

Intersubject relations:

Technique

- Water distribution in the home

Physics

- properties of liquids: incompressibility, fluidity, divisibility, Pascal's law, use of properties of liquids

Chemistry

- Substances and their properties

- water as a chemically pure substance (distilled water)
- water as a mixture of substances (mineral, potable, industrial, waste)
- treatment of drinking water
- wastewater treatment

Biology

- environment
- components of the human environment

Activity 2

1. Find out the content of chemical substances in public water in your area
2. They will find out the chemical composition of the water in the specified location from Internet sources.
3. Through analysis, they will find chemical substances in the water that are harmless to human health. They will determine their quantity, measurement units, detection methods, methods, devices, and chemical analyses.
4. Through analysis, they will find chemical substances and their limit values, which are dangerous for humans. They will determine their quantity, measurement units, detection methods, methods, devices, and chemical analyses.

Intersubject relations:**Technique**

- Water distribution in the home

Chemistry

- Substances and their properties
- water as a chemically pure substance (distilled water)
- water as a mixture of substances (mineral, potable, industrial, waste)
- treatment of drinking water
- wastewater treatment

Biology

- environment
- components of the human environment

Activity 3

1. Students will find out the density of water and the physical laws necessary for the given calculation.
2. They perform the calculation according to the formula $p = \rho \cdot g \cdot h$
3. They will find out what materials water tanks can be made of
4. They will find out how the height of the building affects the container's location.
5. From the following picture, they will find out why there are water tanks on individual buildings in New York.

Intersubject relations:**Physics**

- Power and movement. Work. Energy
- gravitational field, compressive force, hydrostatic pressure, and atmospheric pressure.

Technique

- Graphic communication in technology design, sketch, technical sketch, pictogram, technical drawing,
- Technical materials and working procedures for their processing: working procedures: measuring and contouring, cutting, filing, drilling

B Making a sand filter.

The sand filter consists of several layers of sand with different fractions. For the correct functionality of the filter, the correct layering of the individual layers of sand according to the fraction is essential. A layer of the finest sand with the smallest fraction is applied to the bottom of the container. Additional layers are applied gradually according to sand (aggregate) availability with a more significant fraction. For our model, we recommend at least three different layers with different fractions.

Material:

Plastic container (PET bottle, one pc

Sand (aggregate) of three different fractions approx. 3 x 0.5 kg

Filter paper one pc

Plastic (silicone) tube

Hot melt gun with glue

Drill

Drill with the diameter of the tube.

Sand filter - plastic container (in the picture), it can also be made from a PET bottle, into which the filter is made as follows:

1. Make a hole in the bottom of the plastic container so that a plastic (silicone) tube can be inserted. If we used a PET bottle as a container for the filter, we drill a hole in the lid and cut off the bottom of the bottle
2. Place the filter paper on the bottom of the plastic container so that it covers the entire bottom
3. Pour individual layers of sand into the plastic container so that the sand with the smallest fraction is on the bottom and the other layers with the more significant fraction are on top. Layer at least three layers of sand in the sand filter. You can also use fine aggregate if sand with a more significant fraction is unavailable. The layers of the filter should be up to two-thirds of the height of the entire container.

4. Place a second plastic container under the filter, representing the reservoir for water distribution in the cottage. The presentation (video) uses a teaching aid distributed to primary schools within the Slovak Republic, which the participants of the STEMkey project may not have available. Therefore, it is good to use your own container to represent a water reservoir for the cottage.



Picture 2: Water distribution system

In the student's learning process, feedback about his learning is essential. This information regulates his understanding, and if the student obtains it himself, it significantly affects his self-evaluation and self-awareness. Implementing a research-oriented education model in the subject of technology represents an innovation in the formal assessment of the student in the teaching process. In this way, the results of students' learning activities can be improved in cooperation with the application of experiential learning. At the same time, students' research activities aim to support students' key competencies and 21st-century skills (creativity and innovation, creative and critical thinking, problem-solving, etc.).

The proposed activity and experimental tasks were designed for the 8th year of elementary school (Ďuriš, M. et al., 2023; Pavelka, J. et al., 2020; Stebila, J. et al., 2020). We consider defining intersubject relationships in the individual steps of solving tasks necessary. Emphasis was placed primarily on the Performance Standard, in which performances are formulated in the given thematic unit, which determines what the student should master and be able to perform at the end of the given year in the given thematic unit. Part of the formulated performances also includes the implementation of simple experiments, which should significantly affect the acquisition of knowledge and skills of students in the higher levels of the taxonomy of educational goals, which are necessary for further education and life in the 21st century.

Conclusion

Key competence includes every citizen's knowledge, skills and attitudes to ensure personal fulfilment, sustainable lifestyles, employability, social inclusion, and active citizenship. The core of education in the STEM summer school focused on developing students' ability to apply acquired knowledge and attitudes. Prospective STEM teachers were allowed to expand their understanding of core STEM topics and thus broaden the skills and attitudes of their students. Participating in STEMkey summer school, students had numerous opportunities for cross-cultural exchange, both within the international student body and outside of it, by meeting local students, teachers, and pupils. This allowed them to gain rich experience related to their future profession. The activity that we presented at the event was mainly focused on the issue of water conservation. This appears to be primarily connected with ecology. The solution to the task showed a connection with several subjects of the elementary school curriculum. Although the assignment of the task mainly evokes the financial effect, the economic impact is not as crucial in this case as the ecological and moral aspects. A comparison of water prices in different European countries further emphasises this importance.

The contribution was created as part of the project solution: ERASMUS+KA2 STEMkey Teaching standard STEM topics with a key competence approach, grant no. 2020-I-DE01.KA203.005671 and KEGA 006UMB-4/2022 Implement a research-oriented education model in the subject of technology in lower secondary education, focusing on the cognitive area. The contribution was created as part of the project solution: ERASMUS+KA2 STEMkey Teaching standard STEM topics with a key competence approach, grant no. 2020-I-DE01.KA203.005671 and KEGA 006UMB-4/2022 Implement a research-oriented education model in the subject of technology in lower secondary education, focusing on the cognitive area.

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Experiments to Verify the Properties of Technical materials in the Subject of Technology in Lower Secondary Education

Milan Ďuriš¹, Viera Tomková², Petra Kvasnová³

DOI: <https://doi.org/10.53349/resource.2024.is1.a1241>

Abstract

This paper pays attention to the selected design of experiments that will be part of an inquiry-oriented model of students' education in the subject of Technology in lower secondary education in the Slovak Republic. The proposed model of education reflects the actual long-term objectives of students' education in the subject of Technology, which, despite the content of the curriculum in the updated Educational Standard for the subject of Technology, have not yet been fulfilled. The proposed educational model includes worksheets for students, which contain experiments with a methodology on how to experiment. Students discover new knowledge through inquiry-based activities during the implementation of the experiment, which they evaluate after the worksheet while applying formative assessment of their activity. This assessment includes a student self-monitoring record where the student records his/her response during the experiment and a self-assessment of his/her understanding of the learning unit. The article presents two experiments out of the proposed collection of experiments, along with their implementation methodology. This topic is addressed within the project KEGA nr. 006UMB-4/2022 Implementation of an inquiry-based learning model in the subject of Technology in lower secondary education focusing on the cognitive field.

Keywords: Elementary school, Model of education, Subject Technology, Experiment, Formative assessment

1 Introduction

Over the last few years, students' results in the OECD PISA international tests have resonated in the Slovak Republic, in which they have achieved statistically significantly lower

¹ Faculty of Natural Sciences UMB Banská Bystrica, Tajovského 40, 974 00 Banská Bystrica.

E-mail: Milan.Duris@umb.sk

² Faculty of Education UKF Nitra, Dražovská 4, 949 01 Nitra.

³ Faculty of Natural Sciences UMB Banská Bystrica, Tajovského 40, 974 00 Banská Bystrica.

performance than the average performance of students in OECD member countries. Greater attention is being paid to this problem not only by teachers and the Department of Education but also by parents and society as a whole. The school reform of primary schools in Slovakia is aimed at new goals of education in the 21st century, which is why the Act of the National Assembly of the Slovak Republic No. 245/2008 Coll. on education and training (i.e., the School Act) and amendment and additions to certain acts have set the primary goal of education - educating students to the key competences. In the subject of Technology in lower secondary education, the performance standard specifies the objectives and professional competencies to be achieved and mastered by the student in a given year in the cognitive, affective and psychomotor domains.

2 Starting points of the Problem Addressed

Teaching the subject of Technology in lower secondary education is carried out following the updated State Educational Programme and terms of content according to the revised Educational Standard for the subject. Despite the targeted undergraduate training of future teachers of the subject of Technology at respective faculties, teachers in pedagogical practice do not manage to meet the set objectives in the subject of Technology to the required extent. This is mainly due to:

- insufficient material and technical equipment for the subject of Technology,
- the absence of experimental activities for students with ideas, materials, technologies and Technologies,
- the still predominantly transmissive way of teaching and the dominance of summative assessment of students,
- non-application of students' creativity and ideas in working and experimental activities and other reasons affecting the quality of education in the given subject in individual regions in Slovakia.

The objectives of the subject of Technology formulated in the updated State Educational Programme reflect the subject's content in the 5th — 9th grade of primary school. From the aspect of addressing the given issue within the project, we are primarily interested in the fulfilment of the following objectives in the subject of Technology:

- students experiment with ideas, materials, technologies,
- students distinguish and safely use natural and technical materials, tools, instruments and equipment,
- students apply creativity and their ideas in working and experimental activities,
- students learn to self-evaluate based on the experiments they have carried out,
- students acquire the necessary knowledge and skills relevant to employment opportunities, choice of their career path and further career and life orientation.

The updated Educational Standard for the subject of Technology in the 5th — 9th grade of primary school in individual thematic units also contains a performance standard, which formulates the performances that determine what the student should know and be able to do at the end of a given year within a particular thematic unit (ŠPÚ, 2015).

The assessment of a student cannot only be an assessment of his/her momentary performance but should be directed towards formative assessment and self-assessment. The essence of self-assessment is that students are responsible for their learning and are actively involved in the learning process. From a didactic point of view, self-assessment can be seen as a competence that promotes autonomy and independence from the teacher.

Self-assessment and self-control are the most important motivational tool for the student. Formative assessment of students in the teaching process aims at obtaining feedback on the progress of the student's learning, on weaknesses and mistakes, intending to eliminate them. As stated by several authors (Turek, 2014; Kalaš et.al., 2013; Shute & Kim, 2014; Ďuriš & Stadtrucker, 2016; Ďuriš et.al, 2017; Ďuriš et.al, 2018; Koedinger, McLaughlin and Hefferman, 2010; Ďuriš et.al, 2019; Pavelka et.al. 2020; Ďuriš et.al, 2023), formative assessment of students should be used more extensively as it improves the quality of their knowledge and skills.

To meet the above goals, the inquiry-based model of education will include learning how to apply experiential learning to students, how to use formative assessment to them, and how to develop and support students' key competencies and 21st century skills (creativity and innovation, creative and critical thinking, problem solving, etc.).

3 Structure and Execution of the Proposed Experiments

The structure of the proposed and selected experiments reflects the content of the thematic unit's technical materials and working procedures of their processing, which is included in the updated Educational Standard of the subject Technology in the 6th and 7th grades of primary school. The proposed experiments are part of the designed teaching tool called Workbook for the subject of Technology with demonstration tasks (Ďuriš et al., 2023). In the workbook, students will also become familiar with the basic theoretical information focused on the properties of technical materials (wood, metals, plastics). The individual tasks focus on:

- problem solving,
- development of students' research activities,
- developing and supporting students' key competences and 21st-century skills (creativity and innovation, creative and critical thinking, problem-solving),
- the application of formative assessment of students through a student self-monitoring protocol.

Since teachers cover the content with different emphases, we must keep students aligned. This is done by providing students with basic theoretical knowledge about technical materials,

wood, metals and plastics, and their mechanical, physical, technological, chemical properties (metals) before the experiment.

These properties are characteristic in that they can be observed directly or by simple experiments. Based on an experiment carried out by themselves, students can more easily understand the observed phenomena; they can explain and justify the changes that have occurred in the process of the performed experiment.

After completing each experiment, students carry out self-assessment and self-monitoring using the self-monitoring protocol. In the self-monitoring protocol, they answer the prepared questions focused on the experiment in their own words, and they express in writing their opinion on the experiment, how they understood the learning, and how they worked with the task in the experiment.

Mechanical properties of metals include the elasticity of metals. The structure and methodology of the experiment focusing on this property are given below.

Experiment nr. 1

Elasticity of metals

The aim of the experiment is to determine which of the given samples of metal wire has the most excellent elasticity.

Student's task:

Check the elasticity of the springs, which are made of three different metal wires (zinc-coated, copper and brass).

Tools:

- three different metal wires (zinc-plated, copper and brass) with a diameter of 1 mm with the same length (recommended length = 20 cm),
- coloured pencils (e.g., black, red, green),
- ruler,
- laboratory stand with clamps and holder,
- millimetre paper of A4 format,
- adhesive tape,
- laboratory weights,
- pliers with narrow jaws,
- stopwatch for measuring time.

Work procedure

1. Wrap each wire sample around a pencil. Make sure to leave a 2 cm long straight wire free at the beginning and the end.
2. Make sure that the wrapping is precise and that the different parts of the resulting spring are touching the pencil. If you have followed the correct procedure, you will end up with three springs of the same length.

3. Use the pliers to make hooks for hanging on each end of the springs.
4. Measure the length of each spring when it is at rest (unloaded) and write the value in mm in the table.
5. stick the millimetre paper on the laboratory stand using adhesive tape.
6. Hang the springs on the crossbar of the stand using the hook provided (to prevent the spring from slipping off, we recommend using lab holders to hold the springs in place).
7. Mark the initial length of the springs on the millimetre paper (*black pencil*).
8. Hang weights of equal weight on the free ends of all three springs.
9. Leave the weights for 5 minutes. Mark (*red pencil*) the length of the extended springs on the millimetre paper.
10. Remove the weights from each spring and allow the springs to hang freely for 5 minutes.
11. Record the length of the springs (*green pencil*) on the millimetre paper.
12. Write all the data from the millimetre paper in the table.
13. Based on the comparison of the lengths of the springs at the end of the measurement, determine which spring is the most elastic and which is the least elastic.
14. Write the result in order in the table (**1** - greatest elasticity, **2** - medium elasticity, **3** - least elasticity).

Complete the data in the table.

Spring	Zinc-coated wire	Copper wire	Brass wire
Standstill			
With weights			
Standstill (after weights removal)			
Determination of elasticity			

Explain, in your own words, what has caused the difference in elasticity of individual materials.

..... *student answers*

What is the property that allows a deformed material to return to its original shape when an external force is removed??

..... *student answer*

Write in your own words where a given property of materials is used in household or technical practice.

..... *student answers*

Your comments on the experiment (briefly justify the difficulty and clarity of the learning task):

..... *student answers*

In each row of the table, mark one of the emoticons with an (x) based on your understanding of the task and how you liked the experiment.

How did I understand the lesson? How was it to work out the task?	😊 Very well	😐 Good	😞 I need to improve
1. I know why the spring returns to its original shape when the external force is removed.	()	()	()
2. I understood that not all materials have the same elasticity.	()	()	()
3. I can name the property of metals that allows a deformed material to return to its original shape when an external force is removed.	()	()	()
4. I understood the task and the experiment was clear and interesting.	()	()	()

The technological properties of plastics include their weldability. The experiment's structure and implementation method focused on this property is presented below.

Experiment nr. 2

Weldability of plastics

The experiment aims to observe the weldability of plastics under heat and pressure.

Student's task:

Find out the principle behind a home food foil welder used to prepare packets of cut vegetables, fruit, or meat to be stored in the freezer.

Tools:

- polyethylene foil,
- scissors, ruler, marker,
- 2 laboratory slides,
- alcohol burner,
- matches,
- cold water container (3 dcl jam jar),
- stopwatch for measuring time,
- flat-jaw pliers.

Work procedure

1. Fill the container (jam jar) half full of water.
2. Cut out two rectangles of polythene foil, 40 x 60 mm in size.
3. Place the prepared rectangles of polythene foil between two laboratory slides so that 1 cm of the foil extends over the edge of the laboratory slides.
4. Light a wick with a match on an alcohol burner.

5. Grasp the laboratory slides between which the two rectangular polyethene foils are placed on the shorter side in the pliers.
6. Heat the overhanging edge of the polyethene sheets slowly over the flame of the burner (follow OHS).
7. After 15 seconds, immerse the bonded foil with pliers in a container of cold water.

Explain in your own words what caused the welding (joining) of the polyethene foil.

..... *student answers*

In your opinion, can both thermoplastics and reac to plastics be welded?

..... *student answers*

Write in your own words where the weldability of plastics can be used in real life.

..... *student answers*

Your comments on the experiment (briefly justify the difficulty and clarity of the learning task):

..... *student answers*

In each row of the table mark one of the emoticons with an (x) based on your understanding of the task and how you liked the experiment.

<p>How did I understand the lesson? How was it to work out the task?</p>	<p>☺ Very well</p>	<p>☹ Good</p>	<p>☹ I need to improve</p>
1. I know the reason why two polyethylene foils were welded (joined).	()	()	()
2. I understand that some types of plastics are weldable by heat.	()	()	()
3. I can name the property of plastics that causes them to bond by heat and pressure.	()	()	()
4. I understood the task and the experiment was clear and interesting.	()	()	()

4 Conclusion

We assume that the proposed model of education will not only be demonstrative and exploratory for students, and its implementation will not only apply experimental learning, but also formative assessment of students. This is the intention of the proposed inquiry-based learning model with the application of appropriately designed experiments in the subject of Technology. The given model of education should preferably be adopted by students of undergraduate studies in the Studying Programme Teaching of Technology (bachelor and master studies), the target group is also teachers of the subject of Technology involved in the

extension study of the subject of Technology, as well as qualified teachers teaching the subject of Technology in lower secondary education.

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Teacher education: the key to quality education for future generations

Melánia Feszterová¹

DOI: <https://doi.org/10.53349/resource.2024.is1.a1242>

Abstract

Teacher education is an essential requirement for ensuring the quality and efficacy of education for the younger generation. Competent and well-prepared educators significantly impact the growth of their students' and pupils' competencies, expertise, and knowledge. Therefore, access to professional and pedagogical training that adequately equips educators to confront the complexities and demands of the contemporary educational landscape is critical. In this paper, we address the current issue of preparing teachers with professional qualifications in the science discipline of chemistry. Teacher education encompasses a wide range of requirements, such as professional development, the use of information technology, and pedagogical training. Understanding chemistry is essential for the further knowledge development of the young generation and for preparing them for future career opportunities. This paper highlights prospective measures and solutions that can help improve the current situation in the education sector. Together, we need to look for ways to increase the attractiveness of the profession of a chemistry-qualified teacher and thus promote the interest of future student-pre-service chemistry teachers in studying this science discipline.

Keywords: Teacher, Chemistry, Motivation, New trend, Education, Educational Environment

1 Introduction

The history of human activities shows the development of increasing demands on the teaching profession. Nowadays, education is coming to the forefront of society, which is supposed to form the personality of the pupil and student in the sense of his intellectual and moral improvement, to teach him to know himself and other people, to develop his independence, creativity, and critical thinking (Predanociová et al., 2016). Today, a teacher is not just a specialist who has mastered modern methods of education and upbringing and effectively

¹ Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 01 Nitra, Slovakia.

E-mail: mfeszterova@ukf.sk

uses technical means in the educational process but also continuously improves his professional competence (Mashrabjonovich, 2023).

Perignatova (2019) states that one of the primary factors influencing the choice of profession is the attractiveness of teaching. However, despite this importance and the growing interest in chemistry education, we face a shortage of teachers with professional qualifications in chemistry in schools.

The most important indicator of the teacher's professional competence is his readiness to use innovative forms and methods of teaching and the optimal use of modern multimedia technologies (Mashrabjonovich, 2023). As Enina (2023) states, the development of innovative forms and teaching methods is a prerequisite and a factor for the sustainable development of the educational sphere. The prerequisite for the success of graduates of teacher education programmes in solving problems in their everyday lives is the high quality of knowledge acquired during university education (Pramana et al., 2021).

A shortage of chemistry teachers can hurt the quality of teaching and student learning. Therefore, we must focus on this issue and find ways to resolve it. The characteristic feature of the teacher's professional activity is the adaptation of students to the educational environment, the demonstration of the characteristics of learning and self-education in the educational society and the realisation of the developmental function of learning in the school environment. The teacher's primary role is to actively organise activities to assign students effective ways of working with the knowledge that will enable them to navigate their learning environment and purposefully solve specific learning problems. It is vital to assess how the shortage of chemistry teachers affects our education system and identify areas where changes need to be made.

1.1 Chemistry and its Impact on the Education and Development of the Younger Generation

University education is the most important and best starting point for young people to acquire the knowledge necessary for their professional growth (Romanyshyn et al., 2019; Simonova et al., 2021). An essential prerequisite for each individual for his or her complete application in practice in the field of personal professional interest is completing a university education (Kopas-Vukasinovic, 2014). Chemistry is becoming an integral characteristic of the modern educational space.

Higher education's content, quality, and efficiency are influenced not only by the level of scientific and technical knowledge and dynamically developing production technologies, but above all by the requirements of social and production practice (Renz, Hilbig, 2020). In chemistry, we are at a time when its importance in everyday life and almost all fields (medicine, pharmacy, toxicology, environmental sciences, industry, and technology) is increasingly recognised. It is understandable that in such a changing environment, new

requirements for the content and forms of education are also being created (Kopas-Vukasinovic, 2014; Fischer et al., 2020; Enina, 2023).

The study programmes focused on Teaching Chemistry (combined) result from a long-term development process at universities in the Slovak Republic. Even at present, this process cannot be considered complete. The reasons for this are changing legal standards, new decrees, and regulations in the study programmes. They are aimed at technological and technical development and reactions to social changes, but especially the necessity to harmonise Slovak standards with European ones and their integration into the Slovak education system. Chemistry is one of the critical disciplines providing primary education in science and technology. The need to implement innovative forms and teaching methods in educational institutions' curricula stems from the fact that education that is not varied, motivating, and meaningful can become routine and hinder the training of highly qualified workers (Santos et al., 2020; Enina, 2023).

In this paper, we deal with the current issue of training teachers with professional qualifications in the natural science discipline of chemistry. Teacher education includes several components, such as professional development, the use of information technology, and pedagogical training. Understanding chemistry is essential for the continued knowledge development of the young generation and for preparing them for future career opportunities. This paper explores prospective measures and solutions that can help improve the current situation. It is our primary task to look for ways to increase the attractiveness of the profession of chemistry-qualified educators and to promote the interest of student-pre-service teachers in this science subject.

1.2 Education in the Study Programme Teaching Chemistry (combined)

The current situation of a shortage of teachers with professional qualifications in chemistry in primary schools is serious and deserves our attention. This problem does not concern only the subject of chemistry but most of the science disciplines. It is therefore important to assess how the shortage of science teachers affects our education system and the development of the young generation and identify areas where changes need to be made. We must focus on this issue and look for ways to resolve it.

Improving the quality and efficiency of higher education is now one of the priority tasks of our society. *Teaching and Educational Sciences* in the study programme *1.1.1 Teaching Chemistry Combined* has its social justification. Understanding chemistry is important for the further knowledge development of the young generation and for preparing them for future career opportunities. A shortage of chemistry teachers can harm the quality of teaching and learning for the younger generation.

Slovak universities such as Comenius University in Bratislava, Trnava University in Trnava, J. Selye University, Matej Bel University in Banská Bystrica, Catholic University in Ružomberok,

Pavol Jozef Šafárik University in Košice, and Constantine the Philosopher University in Nitra offer study programmes oriented towards the *Teaching of Chemistry in Combination*. Many of the universities offer a Bachelor's followed by a master's study programme. The primary task of the teacher-oriented study programmes is to ensure the quality preparation of pre-service teachers of science subjects for primary and secondary schools.

2 Constantine the Philosopher University in Nitra (Slovakia)

The Department of Chemistry of the Constantine the Philosopher University in Nitra offers its students, in addition to accredited Bc. and M.Sc. studies, rigorous proceedings and further education in extension studies. In chemistry, we are in a time when its importance in everyday life and other areas is increasingly recognised. Despite this importance and the growing interest in chemistry education, we face a significant shortage of chemistry-qualified teachers in primary and secondary schools.

Education at the Department of Chemistry of the Constantine Philosopher University in Nitra prepares pre-service teachers for bachelor studies in the following disciplines: General Chemistry, Chemical Calculations; Laboratory Technology, Fundamentals of Mathematics for Chemistry Teachers, Inorganic Chemistry; Laboratory Exercises in Inorganic Chemistry, Organic Chemistry 1, 2; Physical Chemistry 1, 2; Biochemistry 1, 2; Analytical Chemistry 1, 2; Laboratory Exercise in Organic Chemistry; Laboratory Exercise in Physical Chemistry, Laboratory Exercise in Biochemistry; Laboratory Exercise in Analytical Chemistry 1, 2; Didactics of Chemistry 1, 2; Theory of Chemical Bonding; Computer Modelling of Molecules; Instrumental Methods; Laboratory Exercises in Instrumental Methods; Technique and Didactics of School Experiments 1, 2; Selected Chapters in Organic Chemistry; Selected Chapters in Biochemistry.

The field of chemistry is implemented in most science disciplines in our universities and colleges. For this reason, many educators are also supplementing their education with another subject of interest: chemistry. Constantine the Philosopher University in Nitra also offers further education in extension studies (Act of the National Council of the Slovak Republic No. 138/2019 Coll.). To date, 28 graduates have completed their extension studies. Further education in the form of an extension 2-year study offers the following subjects for students: General Chemistry; Inorganic Chemistry, Chemical Calculations; Laboratory Exercise in Inorganic Chemistry, Organic Chemistry 1, 2; Laboratory Exercise in Organic Chemistry; Physical Chemistry; Biochemistry; Laboratory Exercise in Physical Chemistry, Laboratory Exercise in Biochemistry; Computer Modelling of Molecules; Processing of Experimental Data; Analytical Chemistry; Laboratory Exercise in Analytical Chemistry; Didactics of chemistry; Techniques and Didactics of School Experiments.

3 Methodology

Potential solutions and measures that could contribute to improving this situation led us to look for ways to find solutions. It is essential to look for ways to make the work of chemistry teachers more attractive and thus promote the interest of students current and pre-service teachers in the subject of chemistry in primary and secondary schools.

Participants

We focused on extension students who graduated from the Department of Chemistry at Constantine the Philosopher University in Nitra in 2010 - 2023. The sample consisted of 20 respondents. The respondents were practising teachers with several years of experience. We chose a survey method in the form of a questionnaire to find out the needs of practising teachers. Interviews with teachers took place before the survey and centred on the needs of students in various age groups and educational goals and objectives. The questionnaire items were designed to help gain an overview of the situation in specific schools while monitoring important information about the shortage of qualified chemistry educators.

Questionnaire

In terms of the questionnaire items prepared, the extension student respondents represented a group that provided relevant information to our survey results. The development of the questionnaire items was a key element. The focus of the questionnaire was the lack of teachers with professional qualifications in chemistry in primary and secondary schools and ways of addressing it. The questionnaire consisted of open and closed items. The logical structure of the questions for the questionnaire was arranged so that the questionnaire would be acceptable to the respondents and that we would obtain the most relevant data. The questionnaire consisted of a total of 15 items.

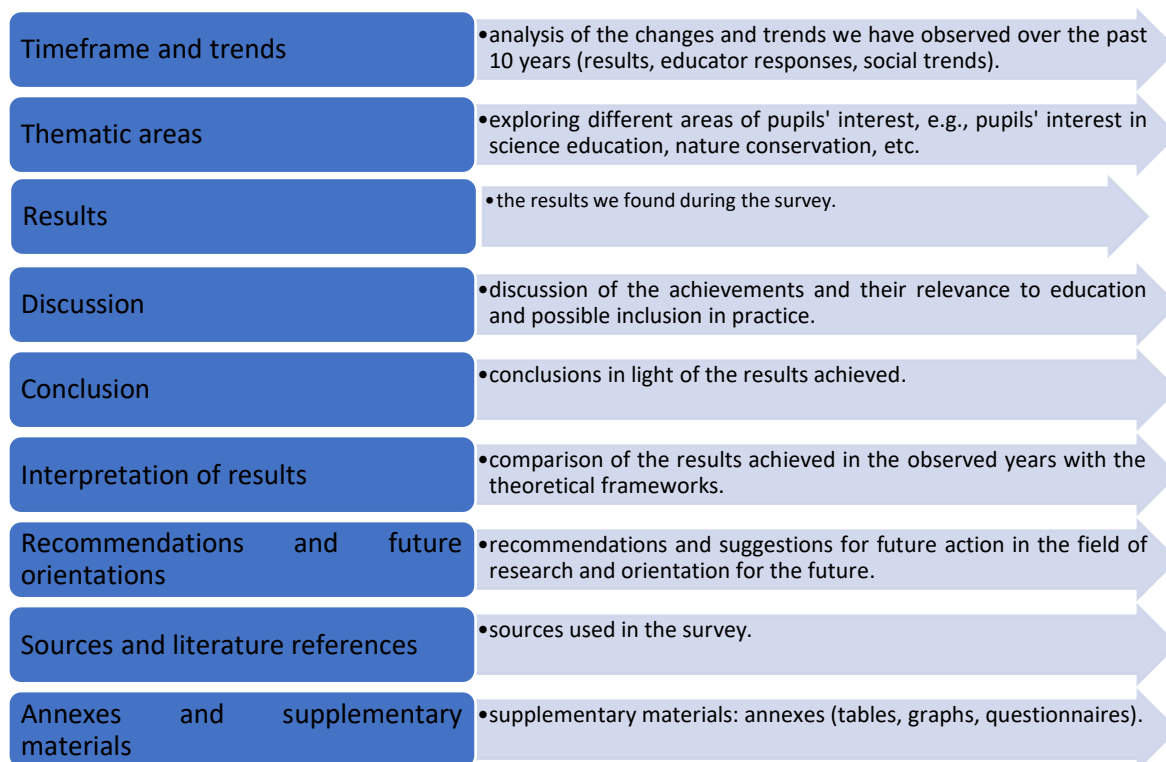
4 Results and Discussion

The survey aimed to find potential solutions and measures that could contribute to increasing the interest of students and practising teachers in chemistry. The actual aim was to improve the quality and efficiency of university education that considers the requirements of contemporary society, embedded in the social functions and fundamental objectives of the different types and levels of the education system. This intention also applies to chemistry, where an effort is made to emphasise the educational and upbringing functions systematically and purposefully within the educational process.

Extension studies in chemistry provide future graduates with new knowledge and practical skills, with an emphasis on laboratory work in the chemical disciplines. The professional competence of future chemistry teachers is a crucial goal. Increasing them will enable them to direct their efforts towards developing pupils' creativity and independence in the

educational process. This is one of the ways it will be possible to activate pupils, leading them to develop creativity and analytical-critical thinking. One of the results will then be the development of pupils' independence and self-assessment skills. The above aspects are essential for the readiness of pupils and students for the challenges of the current and dynamic working environment.

We have divided the research conducted in the extension study over ten years into nine areas based on the aspects under study (Scheme 1). Dividing the survey into these areas helped us structure and present the results clearly and navigate the material.



Scheme 1: Areas of inquiry and their distribution for extension studies (Source: Author)

4.1 The Interpretation of Respondents' Answers

We asked, "*What subject do you teach and in which grades?*" Of the 20 respondents surveyed, 80% answered that they work as teachers of science subjects, including chemistry. 20% of the respondents surveyed taught the following subjects: civics, history, art, occupational education, or were on maternity leave. Many of the respondents have worked or are working as teachers in primary schools and teach all grades of lower secondary education within the Human and Nature educational area.

The following item asked, "*What reasons led you to study chemistry?*" Respondents' answers are summarised in Table 1.

Table 1: Respondents' answers to the question, "What reasons led you to study chemistry?"

Reasons	Respondents' answers
Personal interest:	Knowledge related to the subject of chemistry was a motivation for them. The pupils were often motivated to continue their studies through further education oriented towards the Chemistry Teacher Training Programme (combined).
Professional training:	The study of chemistry provides teachers with professional training in the discipline. With sufficient knowledge of chemistry, they will be able to teach the subject effectively to their pupils, providing them with a comprehensive and quality education.
Expanding and updating knowledge:	Chemistry is not only a natural science but a particularly dynamic discipline with constant development and innovation. Studying chemistry allows teachers to keep their knowledge up to date. They can also keep abreast of discoveries and trends in chemical science and pass them on to their pupils.
Innovative teaching:	Chemistry is an experimental science and can be a subject that is greatly enriched through experiments, hands-on demonstrations, and interactive teaching methods. Studying chemistry allows teachers to integrate innovative and engaging approaches into their teaching, increasing student interest and engagement.
Fostering critical thinking:	Chemistry as a science requires problem-solving skills. Solving them relies on critical thinking and analytical skills. Studying this discipline helps teachers develop these skills in their students, which positively impacts their learning and overall academic development.
Practical applications:	Chemistry has many practical applications in various sectors, such as healthcare, industry, environment, etc. The chemistry study provides teachers with a deep understanding of these applications, allowing them to better connect theoretical knowledge with practice for their pupils.

(Source: author)

A summary of the respondents' answers led us to the following conclusions about the study of chemistry:

- *strengthens teachers' expertise,*
- *contributes to their ability to innovate teaching materials,*
- *supports the development of pupils' critical thinking skills,*
- *leads to the acquisition of practical skills.*

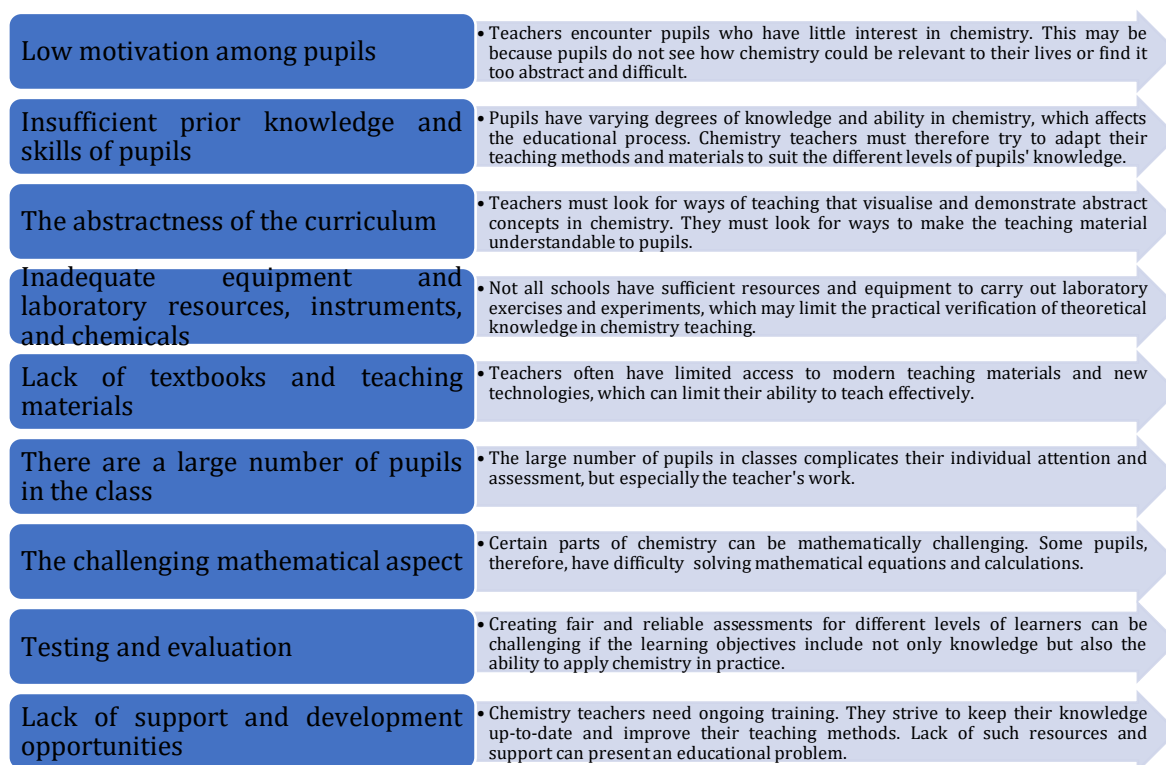
In addition to attractiveness, the fundamental factors include the motivation to choose a profession through studying to meet the qualification requirements, while the overall motivation is intrinsically specific and differentiated (Kolar & Verešová, 2022, p. 81).

The item "What is the staff-professional representation for teaching chemistry, i.e., how many chemistry-qualified teachers are working at your school?" was of interest to us to find

out the actual situation in the schools where the respondents work. Many responses were that one chemistry teacher is working in that school. 20% of the respondents answered that none of the teachers they worked with qualified in chemistry.

For the question, "What is the average number of pupils in classes where chemistry is taught?". The respondents answered that the number of pupils is 15 or more, and only one respondent taught in grade 9, where there were 13 pupils. Since chemistry is an experimental science, we asked the respondents whether the school has suitable material and technical conditions and whether laboratory exercises are part of the chemistry subject. Of the 20 respondents interviewed, 7 confirmed that the chemistry subject also has laboratory exercises to acquire and test pupils' practical skills.

Respondents consider the following to be the most common problems in teaching practice (Scheme 2):



Scheme 2: Missing factors in the educational process (Source: Author)

As Kolar and Verešová (2022, p. 81) state, "There are three reasons why there are fewer and fewer new teachers: recruitment problems (problems with finding a job), problems related to burnout (many teachers leave after a short time), and low motivation (low interest of students in studying teaching)."

A teacher should have a thorough knowledge of his or her field, good pedagogical training, social-character qualities, and competencies for a well-conducted educational process. Solving these problems requires creativity, patience, and cooperation between teachers, schools, educational institutions, and parents.

Teachers' competencies related to the educational process are as follows:

- *professional competence*: competencies acquired based on pedagogical, psychological, and didactic training.
- *performance competence*: working ability conditioned by physical and neuropsychological ability to cope with work stress.
- *personal competence*: social maturity, appropriate character qualities, and will.
- *social competence*: moral qualities of the teacher as a bearer of specific values; by his or her actions, he or she should be a social model for others.
- *motivational competence*: identification with the role of a teacher and commitment to its fulfilment (Dytrtová & Krhutová, 2009).

Kolar and Verešová (2022, p. 81) state that a better understanding of the motives for choosing to become a teacher and why interest in teaching has declined should initiate steps leading to increased interest and improve the attractiveness of teaching.

In the following items, we make some general suggestions that could help improve chemistry teaching in primary schools. Respondents were asked for *suggestions on improving chemistry education and what they see as the main reasons for low pupil motivation*. (Figure 1).

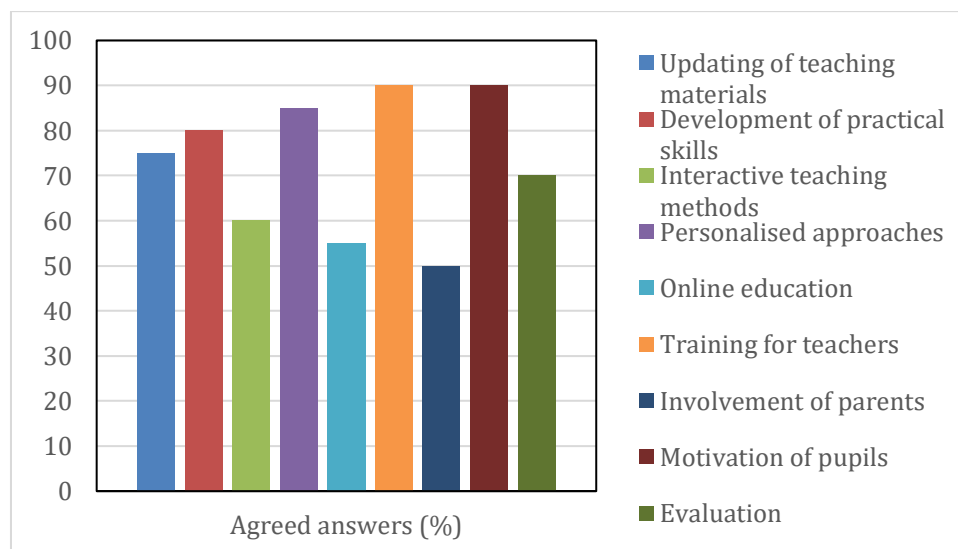


Figure 1: Suggestions of respondents for improving chemistry education in schools

The above suggestions are in response to the problems that educators encounter in teaching chemistry in schools, and their solutions are as follows:

They see *the updating of teaching materials* in the provision of up-to-date teaching materials and textbooks that are relevant to the current state of the art in chemistry. Increasing the emphasis on practical exercises and experiments in the laboratory to help pupils better understand chemical processes, reactions, etc. will also influence *the development of practical skills*. Use of *interactive teaching methods* that actively involve pupils in the teaching process (discussions, group work). *Individualised approaches and support for pupils* should be based

on giving pupils the opportunity to choose from a range of activities on offer (e.g., chemistry club) according to their interests and abilities in chemistry. Create environments to support and develop pupils' knowledge (consultation with teachers) and tutorial support.

Offering *online courses or learning materials* will ensure flexibility in teaching. Ensuring *teachers have access to training* and opportunities to expand their knowledge and teaching methods. As stated by Verešová et al. (2023, p. 43), nowadays, teachers must invest in their professional and career development because society is constantly changing and evolving. Encourage interest in chemistry and learning in the home environment and involve *parents*. Applying chemistry knowledge to real-life practice, such as talks or meetings with chemistry staff in schools, as *motivators for pupils*. *Evaluation* is grounded in the understanding of the learning material, thus ensuring improved ways of assessing and giving feedback to pupils.

Answers to the question of why there is *a shortage of chemistry teachers* in primary, secondary, and high schools and what this is related to were as follows:

- the difficulty of quality vocational training in chemistry may be a barrier,
- the reason is the changes that are taking place in the chemistry curriculum and requirements, which may affect the interest of prospective student teachers in studying the subject of chemistry,
- lack of chemistry teachers may also be influenced by the region (geographical, social, or economic factors) Perignáthová (2019),
- according to Perignáthová (2019), teachers are often also affected by a lack of career development opportunities or low salaries compared to other professions.

Based on the results, a survey aimed at finding solutions to increase the number of chemistry teachers proved that this problem is solvable. For example, further training in the form of extension studies is an option. The interpretation of the results of the questionnaire survey confirmed that the method used is effective for obtaining relevant data.

It is very important to keep track of all relevant supporting information and then focus on solving the problem. To improve the training and shortage of chemistry teachers in schools, it is an important step to find out the causes. The next steps in addressing this problem should include the status of the teacher shortage, the causes and consequences of low teacher numbers, teacher recruitment and motivation, teacher training, and support and professional development for chemistry teachers.

5 Conclusion

The number of teachers in schools is declining as a result of rising demands on them. Constantine the Philosopher University in Nitra's Department of Chemistry educates pre-service chemistry teachers, setting the stage for the training of competent educators who will lay a strong basis for education for the coming generation. This can be seen by looking at a synopsis of the study programmes offered within the context of education at the Department of Chemistry. Nonetheless, we should pay attention to the problem of the dearth of

chemistry-qualified teachers in schools. The scarcity significantly impacts the young generation's education, growth, and other interests. Despite the value and rising interest in chemistry education, there is a severe lack of skilled chemistry teachers in schools. As a result, we must consider this problem and come up with solutions. Simultaneously, curriculum development and funding should be prioritised to inspire pupils to pursue science courses, including chemistry. Access to laboratories, hands-on learning opportunities, and professional educational resources can pique young people's interest in chemistry and subsequently provide a pool of trained educators.

We determined the causes of the scarcity of chemistry teachers based on our survey results. In the context of the discussion, we also put out some possible fixes and actions that might help improve things. A detailed examination of the entire issue and the development of a change process roadmap are necessary to address the scarcity of chemistry teachers in educational institutions. Together, we should explore strategies to raise the appeal of teaching chemistry to students and pique in-service teachers' interest in the scientific chemistry discipline.

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Video Microteaching as an Innovation in University Students' Teaching Practice

Gabriela Gabrhelová¹, Marek Vochozka²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1243>

Abstract

Increasing the quality of undergraduate teacher training programmes and responding to the current needs and requirements are necessary in the modern world. So, DTI University in Dubnica nad Váhom, Slovakia, has implemented an international grant project focusing on applying video microteaching as an innovation in teacher training. The proposed paper aims to draw attention to the benefits of video microteaching as a suitable, effective, and attractive alternative to the traditionally applied methods of teacher trainees' teaching practice, with particular attention paid to the necessity of preparing students for it. The paper presents information about a series of interactive workshops with experienced teachers carried out within the project, where teachers shared their expertise with teacher trainees and provided them with space to develop the knowledge and skills essential for delivering lessons and classroom observations. Also, the results of a brief survey are presented, where teacher trainees provided feedback on the quality and the content of the interactive workshops and expressed their overall satisfaction.

Keywords: Undergraduate teacher training, Video microteaching, Interactive workshops

1 Introduction

Innovations in teacher training and introducing new methods and practices play a crucial role in increasing the quality of education in schools and transforming the school system. It is essential to introduce modern and efficient teaching and learning practices that contribute to the overall enhancement of the educational experience, address emerging challenges, and prepare students for the demands of modern society.

Embracing new pedagogical approaches, ideas, or technologies in schools ensures that education evolves. The ongoing integration of digital tools, online resources, and interactive

¹ DTI University, Ul. Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovak Republic.

E-mail: gabhelova@dti.sk

² Institute of Technology and Business in České Budějovice, Okružní 517/10, 370 01 České Budějovice, Czech Republic.

platforms in undergraduate teacher training brings a range of benefits from the perspective of teacher trainees – e.g. it makes the learning process more enjoyable and effective and enhances engagement and motivation – but it also impacts their future educational work.

Microteaching and video microteaching represent two variations of the same pedagogical approach, i.e. they share the same fundamental principles, but they use different media for observation and analysis.

1.1 The Concept of Microteaching

Microteaching is a teaching method typically used for undergraduate teacher training and uses the elements of classroom observations. Remesh defines it as a teacher training technique for learning teaching skills and emphasises that it employs real teaching situations for developing skills and helps get more profound knowledge regarding the art of teaching. It is a teaching technique where the teaching unit is built up from small segments and allows practising and providing/receiving feedback. Since D. W. Allen introduced it at Stanford University in the mid-60s, it is frequently referred to as the “Stanford technique” and involves six steps: 1. planning, 2. teaching, 3. observing, 4. re-planning, 5. re-teaching; and 6. re-observing (Remesh, 2013).

According to Ismail, microteaching has broad application in teacher training programmes, and its positive impact on teacher trainees’ performance was observed (Ismail, 2011). The typical structure of microteaching is as follows:

1. Short teaching session (5-15 minutes) – the prospective teacher presents a specific lesson or skill to a small group of peers or mentors.
2. Peers or mentors provide the teacher trainee with structured and constructive feedback on their performance, and time for self-reflection and self-evaluation are provided, which help the prospective teacher identify their strengths and areas for improvement (see also Fernandez, 2010).

Grossman states that microteaching's main advantage is linking theory and practice (Grossman, 2005). It helps develop teacher trainees’ professional skills in front of a small group consisting of peers and/or mentors. The teaching session is conducted in a safe and supportive but controlled environment, where mistakes are not considered harmful but something they can learn from. So, the level of stress is reduced. But there are also several other benefits that microteaching offers. It allows teacher trainees to develop specific teaching skills or elements of instruction, practice various techniques, use digital technologies in the classroom, etc. If needed, the microteaching cycle can be repeated several times when the degree to which feedback has been incorporated and the level of progress can be monitored. So, a process of gradual skill development is ensured. The positive effect of peer observation and feedback was pointed out by e.g. Bell and Mladenovic (2008) or I'anson, Rodrigues, and Wilson (2003).

1.2 Video-microteaching

Video microteaching is a more recent form of the traditional microteaching method; it is a variation when video recordings are used instead of live presentation, which means that instead of observing a session live, peers or mentors watch and analyse the record and subsequently provide feedback. From the perspective of the teacher trainee, the disadvantage of this method is that feedback is not provided immediately after the performance. There is always some delay, but on the other hand, video microteaching provides flexibility in terms of timing for both the teacher trainee and the peers or mentors and watching recorded videos also contributes to the development of students' (self-)reflective thinking (Schön, 1983). Teacher trainees can record sessions at any convenient time and watch them multiple times for self-reflection, and also peers and mentors can watch the recordings anytime, repeat viewing, pause watching them, rewind certain parts of the recordings and analyse them in more detail (Snoeyink, 2010), step-by-step, word-by-word, go more in-depth, and only then provide constructive and precise feedback about things that worked well and opportunities for improvement in the field of didactic skills. Video microteaching allows one to pay special attention to the procedures and the methods applied by the teacher, and the session's organisation is discussed in the context of achieving the teaching unit's goals. Watching a video instead of observing it live helps identify features that are usually not noticed in the case of live microteaching (Zhang et al., 2010), e.g. the teacher trainees' non-verbal communication with students, the changing atmosphere during the session, etc. Watching a recorded teaching session and getting feedback from peers or mentors gives a teacher trainee a detailed picture of the lesson.

The results of a survey on microteaching (Hattie, 2013) showed that microteaching ranked 6th among the most effective didactic methods contributing to the improvement of students' skills (Waack, n.d.), which is not a surprise as integrating digital technologies into the teaching process makes it more appealing to the young generation. On the other hand, several drawbacks of video microteaching have also been identified in available studies.

Murphy Odo (2022) states that some students experience nervousness and embarrassment when recording sessions. Others complained about limited opportunities for interaction with peers or mentors as they could not speak directly with them. Being afraid to make mistakes and anxiety were also recorded by Savas (2012).

Video microteaching is also an attractive method for instructors or university teachers as it enables shared learning. The recorded sessions can be easily shared with other teacher trainees, teachers, or mentors, re-used within university courses as examples of good or bad practices, etc. Watching and analysing an intentionally selected session or its particular sequence can develop teacher trainees' teaching skills and optimise their experiences by realising the educational process (Barnová & Krásna, 2019).

2 Video-microteaching and its Application in Teacher trainees' Teaching Practice

In the context of the ongoing digital transformation of society and the digitalisation process in education, new opportunities for the realisation of the educational process arise. This transformation of education related to rapid advancements in technology aims to enhance the overall educational experience and learning outcomes, increase the efficiency of education, make the process more attractive, and increase the quality of education. All these benefits offered by digital technologies should be considered in the case of teacher trainees' teaching practice as well, as their meaningful application can contribute to a better preparedness of prospective teachers for their future profession.

2.1 The Role of Teaching Practice

Although an often-neglected field in Slovakia, teacher trainees' teaching practice (also student teaching) is a critical component of teacher training programmes since it links theory and the educational reality in schools. Becoming a teacher is a dynamic and transformative process, and compulsory teaching practice builds a bridge between what teacher trainees learn in the university environment and the professional responsibilities of being a classroom teacher. The practical experiences teacher trainees gain significantly contribute to their preparedness for performing in the teaching profession. It is an opportunity for teacher trainees to gain practical, hands-on experiences and develop their teaching skills while supervised by experienced in-service teachers and mentors or university teachers, who provide the teacher trainee with help, support, guidance, and feedback. Teacher trainees' teaching practice usually starts with classroom observations, when they can familiarise themselves with school policies, curriculum materials, applied procedures, and the school climate before delivering lessons to be well-prepared for demanding educational work in the classroom.

The field of teacher trainees' teaching practice in the context of the Slovak Republic has been dealt with by several experts (e.g. Spilková, 2003; Geršicová & Gubricová, 2014; Danek, 2019). The authors investigated its issues from two aspects – 1. from the perspective of teacher trainees' teaching practice and 2. from the perspective of in-service teachers.

The theoretical and application level of teacher trainees' teaching practice was elaborated by e.g. Matúšová et al. (2018), who focused on the vocational-didactic module and the teaching practice; Sirotová (2018) paid attention to student portfolios and their role in the context of prospective teachers' (teacher trainees') teaching practice; Lobotková (2018) described teaching practice as a motivation factor for teacher trainees; and also Sirotová and Michvocíková (2019); Michvocíková (2019); Severini et al. (2019); and Danek (2019) paid attention to various issues related to teacher trainees' compulsory teaching practice. In their work, Kancír and Madziková (2018) focused on teaching practice from the point of view of the

development of practising teachers' key competencies and the application of innovative trends in field didactics; and Szíjjártóová and Kramáreková (2019) defined it as a tool for increasing the quality of teacher training. In the Slovak Republic, virtual platforms are not frequently used in this context (Geršicová & Gubricová, 2014).

2.2 Opportunities for Using Video-microteaching

Video microteaching as a part of teacher trainees' compulsory practice is a method or technique that can be well applied in various phases of teacher trainees' teaching practice. It appears to be an effective alternative to its traditional face-to-face forms in developing and refining aspiring teachers' teaching skills. It aligns with contemporary, modern approaches to education and supports cultivating skilled and reflective teachers. Video microteaching – when meaningfully applied – can motivate teacher trainees to work on their improvement since it reveals their weaknesses, evaluates the efficiency of the selected procedures, suggests suitable methods, and gives space for role plays.

As accentuated by Pasternáková and Lajčín (2012), video recordings help link university courses focusing on the didactic and methodical aspects of teaching with real educational situations in schools. It means that the essential requirement when creating videos to innovate the concept of either university courses or teaching practice is to: 1. focus on the didactic and methodic aspects of teaching; 2. focus on actual life application of acquired knowledge; and 3. ensure compliance with the national curriculum policy.

Introducing video microteaching into teacher training stands on two pillars – 1. using digital technologies and 2. teacher trainees' transformation. As with every innovation, it has its supporters and opponents. Therefore, drawing attention to its benefits to all stakeholders is essential. The main advantages of incorporating video microteaching into teacher trainees' teaching practice lie in enhancing the depth of reflective practice and facilitating targeted improvement. However, it also contributes to the overall effectiveness of teacher training programmes.

Barnová et al. (2020) found the following advantages of introducing video microteaching in teacher training programmes:

- video recordings help teacher trainees create a link between theory and practice and make it easier for them to apply theoretical knowledge in everyday educational situations in schools.
- recording lessons in natural educational environments provide teacher trainees opportunities for networking and establishing professional relationships with in-service teachers.
- in-service teachers involved in teacher trainees' teaching practice are “forced” to keep pace with up-to-date knowledge and can also learn from teacher trainees.

As stated above, video microteaching can be used in various phases of their teaching practice, e.g.:

1. prior to teacher trainees' teaching practice in schools:
 - a. as a form of theoretical preparation, when they – under their teachers' or mentors' supervision – watch and analyse teaching sessions recorded by other students as examples of good or bad practice.
 - b. as a form of practical training when their sessions are recorded, and they receive feedback from their teachers/mentors/instructors.
2. during the teaching practice: when the whole lesson or its segments are recorded to be analysed by the teacher, mentor, and/or instructor.
3. following the teaching practice: when the recordings are shared and discussed with other teacher trainees or used as examples of good or bad practice.

3 Research Project

One of the long-term goals of DTI University, Dubnica nad Váhom, Slovakia, is to provide high-quality educational services, to implement new, efficient forms and methods in higher education programmes, to introduce innovations, and to make the offered study programmes accessible to broader masses. These efforts help the University – a private institution providing higher education – maintain its position in the market and gain a competitive advantage.

As a reaction to one of the objectives of the implementation plan for the National Program of Development of Education (2018), which is to increase the quality of teacher training at universities, an international grant project has been implemented at DTI University (WDSC/USA-05/09/21 Video Microteaching as Innovation in University Students' Teaching Practice). It aims to implement video microteaching into teacher trainees' compulsory teaching practice and bring innovation to the content, as well as to the functional and conceptual focus of teacher trainees' teaching practice, which forms a part of obligatory university courses in the study field. Teaching vocational subjects and practical training. The focus of the project is the University's intention to provide its students with alternatives in the form of distance learning opportunities and to make university education more accessible.

Before implementing the research project, teacher trainees' needs were analysed based on their experiences with classroom observations as a part of their compulsory teaching practice. The findings were compared with the results of a previously realised analysis of students' needs at the Faculty of Education of Trnava University in Trnava (Bizová et al., 2015), where video microteaching was also applied. The results of this comparison suggested that video microteaching, if appropriately applied, could be considered a suitable alternative to direct, face-to-face classroom observations.

By the results of an analysis of classroom observations realised within students' teaching practice, the following project objectives were formulated:

- To create a link between theoretical knowledge gained during university studies and the educational reality in schools by providing a concept of basic thematic units based on critical thinking and reflection on teaching situations to be used in university courses.

- To create the content and the focus of the planned teaching sessions corresponding with the educational goals to be achieved.
- To prepare workshops for teacher trainees and make recordings, presentations, and handouts available online for future use.
- To make video recordings in collaboration with selected vocational schools.
- To prepare ready-to-use video recordings for instructional purposes.
- To write a handbook for university teachers/mentors/instructors containing methodical materials on using the recorded teaching sessions for instructional purposes and for teacher trainees and in-service teachers to be used for self-development.
- To make the video recordings and the handbook available online as open educational resources.
- To publish the project results and introduce the innovation in students' teaching practice at DTI University.

The project activities aim to develop DTI University students' professional, practical and application skills in teaching. Creating a series and a database of video recordings capturing typical classroom situations and providing examples of frequently occurring problems during lessons can significantly contribute to the quality of teacher training programmes, including the organisation and realisation of teacher trainees' compulsory teaching practice. University students can develop analytic and divergent thinking processes using video recordings, and their reflective ability for analysing lessons and pedagogical situations can be increased.

When video microteaching is used, teacher trainees' teaching skills and competencies are developed by analysing vocational subject lessons recorded in real classrooms and units of practical training in vocational schools. It is helpful to record both lessons/sessions delivered by in-service teachers and teacher trainees for instructional purposes, as they can be used at different stages of teaching practice.

Video recordings – as the selected medium – can help create a link between university courses focusing on the didactic and methodical aspects of vocational subject teaching and practical vocational training (Pasternáková & Lajčín, 2012; Porubčanová et al., 2016) with the everyday educational reality in vocational schools. They are also helpful in the process of students' (teacher trainees') transformation into teachers.

For teacher trainees, video recordings of teaching units delivered by experienced vocational subject teachers (especially in master's programmes), with experienced teachers of practical training (especially in bachelor's programmes), and recordings of their teaching practice can serve as a motivation factor and provide students with opportunities for self-reflection and self-evaluation.

3.1 Feedback on initial interactive workshops for teacher trainees

Interactive workshops are used in the first phase of teacher trainees' teaching practice when they are introduced to "becoming a teacher". During the workshops, experienced teachers

and instructors share their expertise on effective teaching with teacher trainees and help develop their professional identity. The realised series of workshops was designed to gradually develop teacher trainees' professional competencies by creating a link between theory and practice and presenting in-service teachers' lived experiences. It contained exciting and attractive topics.

An anonymous questionnaire survey was conducted to receive constructive feedback on the series of workshops after training. The questionnaire used in the research consisted of three open-ended questions:

1. Do you consider the realised series of workshops practical from your professional development as a part of undergraduate teacher training? Please explain.
2. Express your opinion about the quality and content of the workshops you participated in and indicate your suggestions or recommendations for improving the quality or attractiveness of the workshops for the eventuality of their future realisation.
3. Please provide a list of themes or topics for workshops you would be interested in as a part of undergraduate teacher training.

Among 23 workshop participants, 17 teacher trainees agreed to provide feedback within the survey. The results show the participating teacher trainees' overall satisfaction with the quality of workshops and the discussed themes. In their responses, they highlighted the importance of "building a bridge" between the newly gained theoretical knowledge and the application of this knowledge in the classroom. They appreciated the examples of good practice and the experiences shared by experts during the workshops and considered them inspiring and motivating. The benefits of the interactive workshops included a better orientation in the field of study, development of theoretical knowledge, selected professional skills, and better preparedness for planning lessons and classroom management. After the workshops, they felt better prepared for classroom observations and delivering lessons during their compulsory teaching practice.

The respondents suggested the following topics for future workshops: lesson planning, curriculum design, educational areas, school legislation, novice teachers, experiential learning, inclusive education, and diagnostics in the classroom. None of the participants had suggestions for improving the quality of workshops.

Based on the obtained results, it can be assumed that interactive workshops carried out before introducing activities related to video microteaching can contribute to teacher trainees' better preparedness for classroom observations, delivering lessons and analysing their recordings.

During interactive workshops, teacher trainees are provided with space for trying out a range of teaching methods and developing their teaching competencies in a controlled environment, in which they receive immediate feedback on their performance that can help them improve their teaching skills.

4 Conclusions

In compliance with current trends in education, it is essential to increase interactivity in pre-gradual teacher training. It also makes teacher training programmes more appealing to candidates by making them more accessible, flexible, practical, and connected with the everyday educational reality in schools. Video microteaching appears to be a suitable alternative to traditional classroom observations and enables highly personalised, individualised, and-paced personal and professional development based on the needs of every prospective teacher. However, it cannot be implemented without activities designed to prepare students for observing, delivering, and recording lessons. For this initial phase of teacher training, a series of interactive workshops was realised and recorded for future use. The appropriateness of interactive workshops was confirmed by their participants, who provided positive feedback on their realisation and their impact on their professional development.

The project's outputs – the series of workshops and a set of video recordings with a related handbook – are primarily intended to be used within the existing bachelor's and master's programme in the field of study, teaching vocational subjects and practical training at DTI University. However, the project team believes they can find a broader application in the Slovak university environment.

5 Acknowledgement

The paper is an output of the grant project WDSC/USA-05/09/21 Video Microteaching as Innovation in University Students' Teaching Practice.

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OSH Education in Schools in the Context of STEM Curricula

Jozef Harangozó¹, Ivana Tureková²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1244>

Abstract

Continuous technological advances are forcing changes in students' education to develop the problem-solving and critical thinking skills needed throughout their studies, in the future workplace and beyond. They can acquire these skills through STEM education, which increases the qualifications of workers who can master the latest technologies and develop new knowledge. For this reason, it is crucial to include OSH education in the educational curriculum. The article aims to raise awareness among those who teach science and technology in schools about the importance of incorporating health and safety for students through STEM education. The article briefly overviews OSH legislation for those who teach in schools.

Keywords: Education, STEM, OSH

1 Introduction

The education of today's youth is crucial. Students must develop skills to succeed in an information and highly technological society. Interestingly, in addition to providing students with basic knowledge in the four areas, they also develop their logical thinking and problem-solving skills, and, last but not least, they learn what it means to work together. In this technological world, we sometimes forget what our foundation is. It is humanity, empathy, understanding and tolerance. These are indispensable aspects of interpersonal interaction and social life that pupils need to learn just as well as those based on the STEM programme. Thanks to STEM, the number of qualified workers has increased significantly. These people are experts in their field of work; they can handle the latest technologies and develop new knowledge. STEM is a form of lifelong learning. Pupils continue using the knowledge learnt in

¹ Department of Technology and Information Technologies, Faculty of Education, Constantine the Philosopher University in Nitra, Dražovská 4, 949 01 Nitra, Slovakia.

E-mail: jharangozo@ukf.sk

² Department of Technology and Information Technologies, Faculty of Education, Constantine the Philosopher University in Nitra, Dražovská 4, 949 01 Nitra, Slovakia.

E-mail: iturekova@ukf.sk

the classroom later in their lives. However, new technologies also bring unknown risks. Occupational safety and health education is often overlooked in vocational education, but it should be an integral and equal part of the preparation in the educational process. OSH education is essential not only in the practical teaching of technical subjects but also in the everyday behaviour of pupils at school. We know from experience that most unpleasant incidents and accidents happen as a result of the undisciplined behaviour of pupils. Thus, teaching pupils to recognise hazards and assess risks is necessary. Creating safe working conditions for children is extremely important in any educational establishment.

The education and training of the next generation require due attention because it is through education and training that we can shape the educational level of the next generation, which will create our society and create values in the future. Therefore, to build and develop safe behaviour and reduce the risk of accidents, we must teach children about health and safety from an early age. It will become a natural part of their plays and their lives. By developing the proper habits in pre-primary education, children will acquire the right attitude to health and safety, which they will carry with them into their working lives. They will then take the principles of safe behaviour for automatic and completely natural.

2 Integrating Occupational Safety and Health into Education and Training

If children start learning about occupational safety and health (from now on, referred to as OSH) as they learn to read and write, it will become a natural part of their work, plays and life. They will acquire the right attitude towards OSH that they will carry with them throughout their working lives. Including the OSH education in individual subjects is better than teaching it separately. Activity-based education and real-life examples will help to convey this message to children and young people (OSHA, 2018).

Occupational safety and health in schools and educational establishments is very complex because it affects not only staff but also children and pupils. In activities related to the educational process, the school must consider the basic physiological needs of children and pupils, create conditions for their healthy development, ensure their health and safety, and provide the necessary OSH information (Písečová, 2019).

Recently, there has been much discussion about connecting vocational training and practice to ensure the „educating“ of new, competent, skilled employees. For this reason, the issues related to ensuring the OSH for students who are practically preparing for their future profession and, at the same time, the issues related to the obligations of employers carrying out vocational practice and education are becoming crucial. (Director, 2015, Kordošová).

2.1 Legislation in the OSH

Legal and other regulations to ensure occupational safety and health in schools and educational establishments are life and health protection regulations, hygiene and anti-epidemic regulations, technical regulations, technical standards, transport regulations, fire protection regulations and regulations on the handling of combustibles, explosives, weapons, radioactive substances, poisons and other substances harmful to health if they regulate issues related to the protection of life and health (Mikula, 2015).

The legal legislation of the Slovak Republic in the field of OSH is based on the “Basic EU Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health protection of workers at work“. It is contained in Act No. 124/2006 Coll. on Safety and Health at Work and in Amendments and Additions to Certain Acts, as amended (where in § 2 it is stated that “the Act applies to employers and employees in all sectors of the production and non-production sphere“), further in Act No. 311/2001 Coll., the Labour Code, as amended, and in Act No. 355/2007 Coll. on the Protection, Promotion and Development of Public Health and on Amendments and Additions to Certain Acts, as amended (Mikula, 2015).

The primary legislative framework for occupational safety and health in education and training is in Section 152 of Act No.245/2008 Coll. on Education and Training (School Act) and in Amendments and Additions to Certain Acts, as amended (from now on, referred to as the “School Act”).

By the above provision, schools and school facilities providing education and training, activities directly related to education and training and services are obliged to:

- take into account the basic physiological needs of children and pupils,
- create conditions for the healthy development of children and pupils and for the prevention of socio-pathological phenomena,
- ensure the safety and health of children and pupils,
- provide the necessary information to ensure the health and safety of children and pupils,
- record school accidents involving children and pupils that occur during the educational process and activities organised by the school. When a school accident occurs, the school must record it (Drotár, 2021).

Other OSH legislation includes:

- **Slovak Government Regulation No. 286/2004 Coll.** establishes a list of prohibited jobs and workplaces for underage employees and certain obligations for employers when employing underage employees, as amended.
- **Slovak Government Regulation No. 281/2006 Coll.** on minimum safety and health requirements for manual handling of loads.

- **Slovak Government Regulation No. 395/2006 Coll.** on minimum requirements for providing and using personal protective equipment, as amended.
- **Slovak Government Regulation No. 387/2006 Coll.** on workplace safety and health marking requirements.
- **Act No. 406/2009 Coll.** on the Protection of Non-Smokers and Amendments and Additions to Certain Acts. ^¾ Slovak Government Regulation No. 392/2006 Coll. on minimum safety and health requirements for using work equipment.
- **Act No. 199/2009 Coll.**, amending and supplementing Act No. 314/2001 Coll. on Fire Protection, as amended and on amending and supplementing certain acts (Kordošová, 2015).

2.2 Adapted Obligations in the Implementing Regulations

The legislation implementing the School Act regulates specific health and safety obligations concerning different types of schools and educational establishments.

Decree of the Ministry of Education, Science, Research and Sport of the Slovak Republic No. 306/2008 Coll. on kindergartens, as amended, regulates health and safety in the provisions of § 7. In the sense of paragraph 1 of the provision in question:

“The principal is responsible for creating safe and sanitary conditions for pre-primary education.” According to paragraph 2 of the provision mentioned above, “The pedagogical staff of the kindergarten is responsible for the safety and health protection of the child from the time they take the child until the time they hand the child to the legal guardian or an authorised person.”

The cited provisions define the material, personal and temporal scope of responsibility for the safety and health protection of the child in the kindergarten. Given the young age of the children attending the kindergarten, the responsibility of the teaching staff here is very broadly conceived.

Decree No. 320/2008 Coll. on Primary School, as amended (from now on, referred to as the „Primary School Decree“), also contains provisions relating to pupils' safety and health protection. However, unlike the Decree mentioned above, these are not comprehensively regulated in a single provision but are scattered in several places (Drotár, 2021).

3 OSH in Education

A pupil has the right to education and training in a safe and hygienic environment but is also obliged not to restrict the rights of other persons participating in the educational process. (Písečná, 2019)

Schools and school establishments providing education and training of pupils and students have many serious obligations and tasks in the field of health and safety resulting from work, legal, safety and technical and health and hygiene regulations and special regulations of the Ministry of Education, Science, Research and Sport of the Slovak Republic, including its methodological measures and instructions.

OSH is a state of working conditions that eliminate or minimise the effects of hazardous and harmful factors of the working process and working environment on the health of employees and pupils (Mikula, 2015).

4 Conclusion

Care for health and safety at work, in education and in teaching is an equal and integral part of the educational process's preparation, implementation and evaluation. We know from experience that most unpleasant incidents and accidents occur as a result of the undisciplined behaviour of pupils. Occupational safety and health in schools and educational establishments is very complex because it is necessary to ensure occupational health and safety for children, pupils, students, and staff.

Teachers need training on how to teach OSH. If they do not receive such training and OSH education is only one of the options in the curriculum that they have to choose, they may be unwilling to teach the subject and choose one that suits them better, even if they have the appropriate resources. For this reason, training programmes are necessary for qualified teachers, and it is crucial to include OSH education in the curriculum of teacher education courses for future teachers. Teachers at all levels of education need such training.

Acknowledgements

This paper was written in the context of the KEGA project No.018UKF-4/2023, Further Education of Teachers in the educational area Man and the World of Work and the VEGA project No. 1/0213/23 Developing the Learning Potential of pre-school and Younger School-age children in the focus on the concept of STEM education.

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Pupils' Access to the Teaching of Vocational Subjects at Secondary Vocational Schools

Ján Hargaš¹, Darina Matisková², Branislav Hargaš³

DOI: <https://doi.org/10.53349/resource.2024.is1.a1245>

Abstract

The present article deals with a survey conducted among secondary vocational school pupils to find out what is causing a decline in interest in studying at secondary vocational schools among the pupils of selected primary schools in the Slovak Republic. The article evaluates the influences that can motivate students to choose a secondary vocational school and why they prefer to study at grammar schools. The result of the survey is the improvement in the student's attitudes towards the subjects taught in secondary vocational schools while they are still in elementary school.

Keywords: Pupils, Motivation, Professional subjects, Communication, Research

1 Introduction

Today's big problem faced by our society and the education system is the need for graduates to succeed in the labour market, find an appropriate occupation and develop their careers. The issues regarding selecting a secondary school and choosing the direction of one's future career should be discussed as early as elementary school. Therefore, particular attention should be paid to the teaching methods and the extracurricular activities in elementary schools, as improving these could affect pupils' attitudes towards vocational subjects taught in secondary vocational schools. Current forecasts show that the occupations most in demand are those in the service sector and the professions that require a high level of technical skill. The opinions held by parents and children are distorted by a belief that secondary vocational schools are only appropriate for pupils who receive lower marks and have a limited chance of being admitted to a grammar school. A significant part of the population has the ambition to complete university studies, while

^{1,3}DTI University, Ul. Sládkovičova 533/20, SK - 018 41 Dubnica nad Váhom, Slovak Republic

E-mail: hargas@dti.sk, hargasb@dti.sk

²Faculty of Manufacturing Technologies of the Technical University of Kosice with a seat in Prešov, Bayerova 1, 08001 Prešov, Slovak Republic

E-mail: darina.matiskova@tuke.sk, darina.matiskova@gmail.com

studying at a secondary vocational school is not associated with such a plan. As a result, the objective of this study is to characterise the factors that affect the selection of a secondary school, as well as the competences of teachers in this area, as they play an essential role in the pupils' attitudes towards the subjects taught at secondary vocational schools.

1.1 External Factors that affect Selecting a Secondary School

The primary group of people with whom an individual interacts is the family. The family is an environment where a child's personality is shaped and where all stages of life are experienced. We are born into the so-called family of orientation, i.e. the family of origin, in which we exist and maintain contact throughout our lifetime. Later, we create a new family, the family of procreation, in which we assume the role of a parent. However, one's personality is most affected by the so-called nuclear family, which consists of parents and children. A child's personality is also shaped by the extended family – the grandparents, siblings, and relatives (Koča, Havlík, 2011).

The Great Sociology Dictionary (Maříková, 1996) states that a family is the original and the most important social group, and the institution that constitutes the fundamental element of the social structure, as well as the primary economic unit, and that its leading roles include reproduction, survival of humans as the biological species, education, socialisation of children, as well as the transfer of cultural role models and the preservation of the continuity of cultural development.

The characteristics of a modern family, according to Zapletal (2015, p. 55-56), are as follows:

- Most frequently, a family includes two generations (parents and children); the coexistence of more than two generations is now very rare.
- A significant focus on the interests of an individual: the search for life, the preference for one's own needs over the interests of the society.
- Absent expectations of enduring relationships; an individual does not want to risk and reserves some space for potential changes.
- Frequent "trial partnerships" are long-term permanent relationships with children without a formal marriage.
- Postponing parenthood for later; a consequent decline in birth rates; possibly also unwillingness to abandon the lifestyle without children, a developing career, or due to health issues associated with higher age.
- The direct educational role of parents is increasingly assumed by institutions and other socialisation influences (peers, media, etc.)
- In increasingly frequent families where both parents pursue their careers, while the childcare is transferred to a third party, e.g., grandparents, tutors, boarding schools, etc., both partners strive for promotion in their careers.

- Activities that the family previously provided are now provided by the society (preschool and school establishments, service providers, catering establishments, etc.)
- Regular intergeneration contacts are not very intensive and are limited to two generations only (parents and children); diversion from a typical family coalition (a dominant and more hostile father and affectionate and more submissive mother) towards a wide range of alternatives.

As with any other group, a family also serves its functions. According to Prokop (2001, p. 42–45), the essential functions of the family include the educational, economic, biological, and emotional functions.

1.2 School and the School Environment in a Potential School

The crucial factors that affect the pupils in selecting a secondary school undoubtedly include the school and the school environment. Because an individual comes to a new environment, where he or she must adapt, integrate into a new collective, and engage in interactions with people in such a new environment, all that affects the development of that individual. The resulting impact of those factors is that the individual's values and goals are altered or become more specific.

According to Grecmanova (2008, p. 31–32), a school is an institution whose traditional role is to educate and train. It is under the pressure of societal expectations since it fulfils essential functions, such as socialisation and personalisation. Moreover, a school facilitates the young generation's gaining qualifications and is a place where various groups and generations meet. In addition to gaining new knowledge, pupils develop social behaviour in schools.

The critical aspects of the school education include:

- Promotion of the pupil's independence and development.
- Development of social competences (morality, tolerance and "fair play") and social behaviour (teamwork).
- Initiation of the social engagement (readiness to help, general effort) of pupils; a demonstration of the future perspective; efforts aimed at meaningful and achievable goals that lead to one's satisfaction.
- Realistic formulation of tasks and the implementation of those tasks while considering the pupil's capacities, learning support, etc.

On the other hand, the teacher's efforts may be dishonoured without the support from the family and the family environment, in which the relatives show their interest in the pupil's achievements and interests, and how he or she perceives the curriculum. In the family environment, children have an opportunity to ask for clarification of what they do not understand correctly, and they receive support for their efforts. The impact of the

environment where a child is raised has the potential to surpass (in the negative sense) even the child's projections of his or her personality and potential. If the child is deprived of the support, or if the child does not receive sufficient support that is required for the development of his or her knowledge and skills, it also affects the child's motivation to strive for a certain position in society in the future, including the selection of secondary education.

1.3 School and School Environment as the Starting Point

The quality of school life is closely related to the term "good school". The characteristics of a good school include:

- Both pupils and teachers accept it since they share this environment and engage in meaningful activities. In this environment, children may experience the joy of learning, and teachers may practice "open and developing teaching".
- Adults and children are encouraged to engage in adventures, in thinking and working; they all like helping and advising each other; they strive to create an atmosphere of trust, mutual support and recognition of their authority without fear; teachers have enough patience and time, and provide assistance to children; teachers do not only provide new knowledge and determine the behavioural rules, above all, they teach them to ask and present arguments, respond and explain reasons, create their own opinions and act responsibly;
- The vital sensory experiences are gained through interpersonal relationships; another important aspect of school life is the responsible building of such relationships – this means that in a good school, the teacher:
 - Recognise their critical roles in encouraging and supporting pupils and promoting collegiality with other teachers; ask about the pupils' living conditions, significantly to help them succeed not only in the school environment but also in their future careers; communicate with pupils primarily through arguments and questioning; and encourage them and not only give commands and limit them.
 - Believe that every individual has a good side (despite the contrary experience) and build trust, not fear in pupils; they should respect that they are less likeable and sometimes disoriented and pay the same attention to such people.

A good school's features include:

- Clearly defined educational and extracurricular goals.
- Pedagogical optimism assumes that pupils want and can learn something.
- Pedagogical engagement of teachers; taking care of the well-being of all pupils.
- Controlled diagnostics and support in achieving the desired effects of the learning.
- Implementation of the minimal rules of discipline and order and clearly defined procedures; strict adherence to those rules and procedures.

- Qualified management of teachers by the principal, individually and collectively (optimism, ability to solve conflicts, creative personality, engagement, etc.)
- Atmosphere of trust based on the personal contacts (between the teachers, pupils and parents), identification with the school and the feeling of collaboration.
- Good organisation of work; cooperation among teachers (shared projects, inspections in lessons, supervision, etc.); readiness of teachers to implement innovations.
- Engagement of parents; support by the pedagogical supervisors through the human and financial potential. (Prokop, 2011, p.67–72).

Teachers and their competences:

One of the key factors that affect the decision-making of pupils when selecting a secondary school is the impact of their teachers. “The quality of a teacher’s personality has an educational impact not only through shaping the pupils’ personalities but also on the relationships among the pupils. The teacher influences, positively or negatively, the atmosphere in the classroom.” (Dravecký, 2006, p. 38)

Concerning the need for a high-quality and healthy atmosphere in the environment for working and learning, it is necessary also to mention the atmosphere in the school and the classroom. The results of the pupils’ efforts and the quality of their work are positively influenced by a relaxed atmosphere without fear, pressure, and tension. One of the teacher’s tasks is to ensure a pleasant atmosphere in the classroom to enable the pupils to achieve the best possible results and, at the same time, allow the teachers to deliver their best performance, to provide the pupils with the information that is necessary for the further development of their personalities.

Petlák (2006, p. 9) stated that “multiple factors significantly affect the pupils’ performance and study results; however, it seems that some of them are underestimated in the real-life teaching process, and they are often regarded as granted or less important. Those factors include the atmosphere in the classroom and the school.”

The quality of the relationships between teachers and pupils is affected by:

- The scope, extent, and depth of the teacher’s educational impact; the learning by the pupils and the teaching process (the attitudes of the pupils towards the school subjects); the course of the lesson (the atmosphere in the lesson); the relationship to the school as such; as well as the mental health of teachers and pupils.
- The relationships between the teachers and the pupils are logically established through continuous interactions. The teacher develops a relationship with the pupil and the class. At the same time, every pupil develops a relationship with the teacher – it is referred to as the emotional connection between the pupil and the teacher. The teacher’s relationships with the individual pupils are referred to as the individualised relationship between the teacher and the pupil. This type of relationship may be the basis for building a unique approach to a particular pupil. The teacher’s individualised relationship with the pupil should be maintained while considering the following:

- Special characteristics of the pupil: the pupils’ interests, capabilities, talents, health and learning disorders, as well as their causes (dysfunctions); the living conditions: the family environment, quality of living, attendance to school; the environment where the pupil lives: the parents’ interest in educating the child, the relationship between the parents; the family environment: divorced parents, fighting in the family etc. (Dravecký, 2006 p.58–59).

Based on the facts above, it should be noted that the family environment, as well as the school environment in elementary schools, substantially impacts the pupils’ decision-making when selecting either a secondary vocational school or a grammar school.

The following graph presents the percentages of students who have registered for the individual types of schools in the school year 2023/2024.

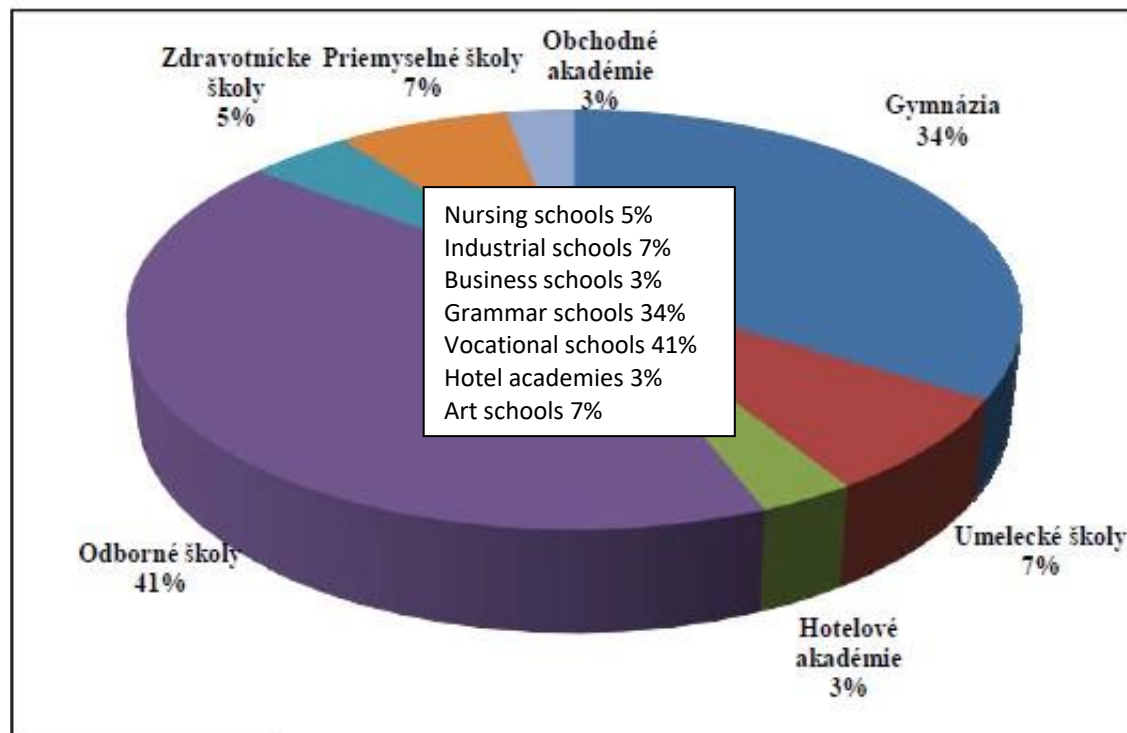


Figure 1: Percentages of pupils who have registered for the individual types of secondary schools in the school year 2023/2024 (Source: Statistical Office of the Slovak Republic)

2 Survey methodology

Table 1 presents the data on the analysed secondary vocational school and the elementary school, as well as their comparison; the data show how many elementary school pupils have registered for grammar schools or secondary vocational schools in the individual school years.

Table 1: Comparison of the analysed schools and the pupils who have registered for secondary vocational schools or grammar schools.

	Year	Grammar schools	Secondary vocation schools
Joint School	2019/2020	35%	65%
	2020/2021	34%	66%
	2021/2022	33%	67%
	2022/2023	33%	67%
Primary schools	2019/2020	43%	57%
	2020/2021	43%	57%
	2021/2022	44%	56%
	2022/2023	43%	57%

(Source: author)

The survey aimed to analyse and describe pupils' attitudes toward vocational subjects taught at the studied joint secondary school and the elementary school. The survey's focus was the "Attitudes of pupils towards the vocational subjects taught in the elementary school". The survey tasks were as follows:

- To identify the factors influencing the pupils when selecting a secondary school.
- To identify whether the teaching method at the elementary school affects the decision-making in selecting a secondary school.
- To identify pupil attitudes towards the vocational subjects taught in secondary vocational schools.

A hypothesis is a conditional statement that presumes a relationship between two or more variables. The survey was carried out in the form of a questionnaire. Based on the survey tasks, the following hypotheses were formulated:

H1: When selecting a secondary school, their parents influence the pupils the most.

H2: When selecting a secondary school, neither the pupils nor their parents consider the needs in the labour market.

H3: The teachers may influence pupils' attitudes towards the vocational subjects taught in the secondary vocational school.

The questionnaire contained several questions, one of which significantly impacted the entire survey.

Question: Which factors strongly influenced your decision when selecting a secondary school (your family, your teacher or educational counsellor, or your friends and classmates)? The answers to that question are summarised in the graph presented in Fig. 2

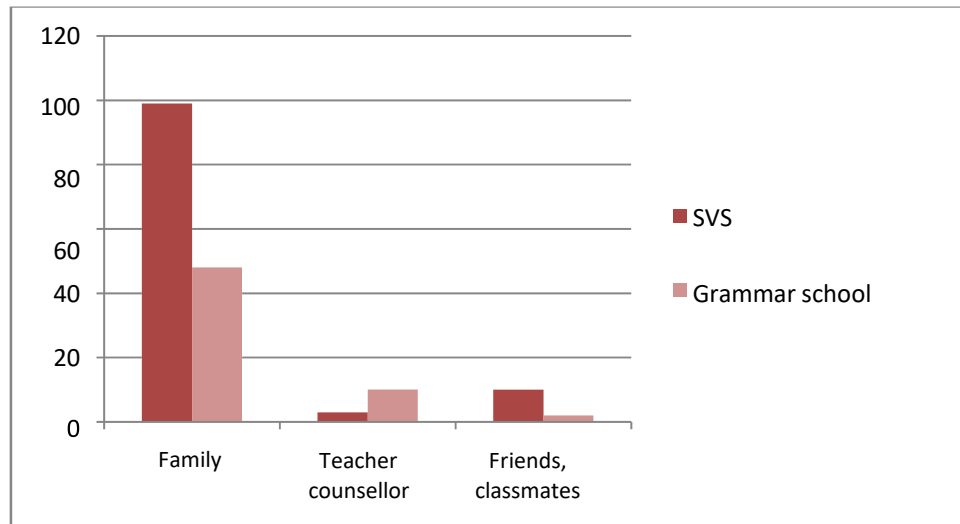


Figure 2 Factor with the strongest influence on the pupils when selecting a secondary school.

The graph above clearly indicates that the family had the strongest influence on the decision-making in selecting a secondary school for both the secondary vocational school and the grammar schools. Out of the total number of 172 respondents, as many as 147 pupils (85%) reported that their family had the strongest influence on their decision when selecting a secondary school; out of that number, 99 pupils were from secondary vocational schools, and 48 pupils were from grammar schools.

3 Discussion

In the final step of the survey, it was necessary to describe the findings resulting from the analyses of the pupils' attitudes towards the vocational subjects taught in secondary vocational schools, and what influences the pupils of elementary schools in their decision-making when selecting a secondary school for their future studies.

It is sad that increasingly fewer pupils hold positive attitudes towards vocational subjects. Each year, the number of pupils registering for secondary vocational schools decreases. That is why the attitudes towards vocational subjects among pupils in primary schools were analysed. We believe that to achieve that the pupils have a positive attitude towards the vocational subjects, it is necessary to start building such attitudes early. The teaching methods applied in two different elementary schools were compared. In one of the analysed elementary schools, the pedagogical staff teaches the pupils various technical skills through numerous projects as early as in the nursery school. Teachers strive to discover the talents in their pupils, and in cooperation with their parents, they support the pupils in developing those talents and building a positive attitude towards the vocational subjects taught at the higher level of secondary education. Moreover, statistical data on the number of pupils registered

for different types of secondary schools were compared. The survey results showed that the elementary school with the teaching methods that contribute to building a positive attitude towards vocational subjects at an early age also had a higher number of pupils who later registered for secondary vocational schools. Based on that data, it is possible to state that the teaching method and the practical training of specific skills is the path other elementary schools should adopt because children begin to build their attitudes towards vocational subjects in early childhood. The survey also focused on the factors that affect the decision-making in selecting a secondary school. During the initial meetings and consultations regarding the situation in elementary schools, it was possible to conclude that the parents interfere the most with their children's decision-making when selecting a secondary school. Children do not seek advice from their educational counsellors or possess information on the current needs in the labour market.

The pupils of two secondary schools, including one grammar school, represented the focus of the following part of the survey. The questionnaire results identified the factor that most influenced the pupils' decisions when selecting a secondary school based on the pupils' attitudes towards the vocational subjects. Another goal of the survey was to determine whether the pupils were allowed to develop their skills and capabilities in any of the vocational areas. The determined hypotheses were assessed based on the questionnaire results, while the initial assumptions were eventually confirmed. When selecting a secondary school, their parents influence the pupils the most. The findings also showed that neither the parents nor the children consider the current needs in the labour market, and they do not communicate with competent experts regarding the choice of a secondary school. Furthermore, the questionnaire results indicated that the pupils' attitudes towards the vocational subjects may be altered during their studies. It is therefore necessary to educate and train the pupils through practical activities in which they may use their theoretical knowledge. Such valuable training will prepare them for their future. That is one of the reasons why education in vocational schools is now being transformed to adapt it to the current real-life requirements. In cooperation with certain employers, the government has introduced the "dual education" system, which directly interconnects secondary education with practical training conducted directly in the facilities of potential future employers.

Our country needs qualified experts, so our primary goal should be to focus on working with pupils in elementary schools – introducing various occupations to children, letting them discover their skills, and supporting their further development. In addition, secondary schools should also be paid more attention since they are the institutions where theoretical knowledge may be practically applied. The attitudes towards vocational subjects are built throughout their lifetime and may also be influenced. Schools, in particular, are the institutions that play an essential role in this process.

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Integration of STEM education into the undergraduate teacher training

Alena Hašková¹, Martin Bílek², Gultekin Cakmakci³

DOI: <https://doi.org/10.53349/resource.2024.is1.a1246>

Abstract

Although teachers' opinions on implementing integrated thematic education in schools (its incorporation into traditional teaching) and designing school curricula based on cross-curricular relations are different, its application in the educational process undoubtedly brings various benefits. The authors deal with the possibilities of integrating STEM topics teaching into pre-gradual teacher training. For this purpose, unique teaching materials were created in the frame of an international project. Primary attention within the paper is paid to the presentation of these materials. However, the authors deal more specifically with teaching materials supporting firstly technology and engineering education. In this context, topical and pedagogical aspects of overlaps of these two areas are pointed out.

Keywords: STEM education, Teacher training, Teaching materials

1 Conception of STEM Education

The conception of STEM education is based on the integrated provision of basic knowledge in science, technology, engineering, and mathematics while trying to develop the logical thinking of students (pupils) and their ability to solve problems, especially in cooperation. The mentioned four areas are considered the key areas of the 21st century for achieving success in education and subsequently in a person's career, for progress in innovation, for maintaining economic competitiveness, for environmental protection, and for one's participation in a democratic society.

¹ Faculty of Education, Constantine the Philosopher University, Drážovská 4, 949 74 Nitra, Slovakia.

E-mail: ahaskova@ukf.sk

² Faculty of Education, Charles University, Magdalény Rettigové 4, 116 39 Praha 1, Czech Republic.

E-mail: martin.bilek@pedf.cuni.cz

³ Faculty of Education, Hacettepe University, 06800 Beytepe, Ankara, Turkey.

E-mail: cakmakci@hacettepe.edu.tr

Although the meanings of the separate letters in the given acronym are precise, there is no consensus on precisely what, under these letters, should be taught within the school curriculum. Moreover, not each educator has a clear idea of what knowledge and processes are or should be considered about each of the four areas.

The least problematic area is mathematics. Until recently, quite a straightforward matter was also the position of the first letter S for science in the acronym. In general, this was understood as bringing into the school systematic scientific ways of discovering new facts and achieving new knowledge on the things around us, ways which are based on observations, experimental activities, and related measurements, which results in making general conclusions and formulation of general rules and laws. In this context, besides problem-based teaching and learning mainly, the use of inquiry-based teaching has been supported or preferred (Kožušková et al., 2023; Dostál & Kožušková, 2016).

However, a more and more often raised question is whether the letter S, which is in the acronym meant preferably for natural sciences, should not be perceived as the other branches of science, e.g., human sciences or social sciences. Raising this question can be related to the tendency to broaden the acronym STEAM by a letter A, i.e. instead of STEM, to have STEAM. Integration of the letter A for arts into the acronym is related to the fact that different kinds of technology and engineering phenomena are becoming increasingly used in arts. As proof of this, one can mention digital photography as an entirely new kind of art.

According to Cíbiková & Petrášová besides the mentioned, a much more serious problem is an appropriate understanding of the terms technology and engineering within the STEM acronym (Cíbiková & Petrášová, 2023).

As to the term technology, on the one hand, educators connect this term with the use of information and communication technologies in the frame of teaching and learning processes, and on the other hand, they usually narrow the scope of the term technology only to skills and knowledge related just to computers and their programming. In this context, it can be concluded that, in general, the common public and most educators give an equal sign between the terms of technology and computers. But computers, or information and communication technologies alone are only one kind of technologies which we are facing in our everyday daily life (either in their hidden or open forms, as e.g. manufacturing technologies, power technologies, automotive technologies, water or heat distribution technologies, household technologies, etc.).

The situation with understanding the term engineering is even worse. For most people, it is difficult, or even impossible, to specify the content of the term engineering precisely and distinguish differences between science and engineering (to state the standard and specific features of each of these phenomena).

An overview of the similarities and differences between science and engineering is presented in Table 1.

Table 1: Similarities and differences between science and engineering.

	Science	Engineering
Definition	Science is a way of learning about things; it is a process we use to understand the natural world.	Engineering is both a body of knowledge - about the design and creation of human-made products - and a process for solving problems.
Questions posed	Science asks next questions about the natural world: What is the material world like? How can we explain what we see? How do we know what we know?	What/how can we build, invent, market, and/or make an impact?
Purpose and goals	To produce evidence-based explanations of the natural world	To produce a systematic, often iterative, and interactive approach to designing objects, processes, and systems to meet human needs and wants
Goal	To persuade scientific peers or the public in general	To satisfy a client
Outcomes	Discovery and invention of theories and laws	Invention of processes, solutions, artefacts, and technology
Methodology	There is no single, universal scientific method. Varieties of scientific methods Understand relationships among causes and effects and examine the variables' impact.	Manipulate and optimise variables believed to cause the desired outcome using appropriate design approaches (e.g. engineering design process, design thinking process, etc.)
Intention and underlying motivation	(Intellectual) curiosity-driven	User-centred, need-based, meaning-based needs, moving from abstraction to application
Profession	A scientist is someone who investigates various aspects of the natural world to have a better understanding of how things work and function.	An engineer is someone who uses their knowledge of science, math, and creativity to design objects, systems, or processes to meet human needs and wants
Boundaries and constraints	Deals with the natural world	Works within the natural world and is constrained by legal, economic, environmental, industrial, etc. factors. Makes trade-offs between criteria and constraints

(Source: G. Cakmakci: Integrating epistemic practices of engineering into education)

Engineering is a unique field with its peculiar history, ways of knowing, and practice. There are several widely accepted definitions of engineering. For example, the International Engineering

Alliance (2021) defines engineering as an activity essential to meeting people's needs, economic development, and providing services to society. The definition shows that engineering is not just applied science but a mindset and sometimes a way of life. A habit of mind is a usual way of thinking and engaging with the everyday world. Engineering habits of mind describe how engineers think and act while making things as they engage with challenges or opportunities. According to the Royal Academy of Engineering committee (RAE, 2014), habits of mind associated with engineering include systems thinking, problem-finding, visualising, improving, creative problem-solving, and adaptability. Therefore, all citizens should learn engineering practices to overcome challenges in their daily lives (Aydeniz & Cakmakci, 2017; Cunningham & Carlsen, 2014; Cunningham et al., 2018; McComas & Burgin, 2020; Sun & Strobel, 2014).

2 Integration of STEM Education into Teacher Training

Although teachers' opinions on implementing integrated thematic education in schools (its incorporation into traditional teaching) and designing school curricula based on cross-curricular relations are different, its application in the educational process undoubtedly brings various benefits. The most significant can be the activation of pupils' or students' activities, deepening their understanding of the connections between knowledge and skills acquired within different teaching subjects, but also within different areas or the thematic units of the same subject, pointing out the everyday use, or usability of acquired knowledge and skills in everyday life situations (Kuchárová, 2012).

Potential possibilities of including STEM education into the (curricula of) undergraduate teacher training can be summarised in the following points:

- implementation of STEM education within a separate subject (course),
- implementation of STEM education within thematic units focused on educational STEM activities included in various teaching subjects (courses),
- implementation of STEM activities provided by external lecturers without any direct connection to any teaching subject (course),
- implementation of project days without any direct link to any teaching subject,
- implementation of a minor (bachelor's or master's) study program focused on teaching integrated STEM subjects (as a teacher's major),
- Implementing STEM education as a teacher's study program focused on teaching integrated STEM subjects (as a teacher's major).

Besides undergraduate teacher training education, other possibilities for how to train teachers for the application of STEM education to schools (into the teaching and learning processes):

- to carry out consecutive STEM education or study following a master's degree,
- to carry out extended teacher education study programs focused on teaching integrated STEM subjects (as teachers' further major),

- to carry out (CPD) courses on the application of STEM education within the further (lifelong) continuous education of teachers,
- to carry out summer schools for teachers, focused on applying the STEM education concept within various teaching activities.

3 Improving Teacher Trainees' Readiness to Apply STEM Education at Schools

To support teacher trainees' preparation in the application concept of STEM education in their future practice at schools, several higher education institutions representing 12 European countries (Austria, Croatia, the Czech Republic, Cyprus, Germany, Lithuania, the Netherlands, Norway, Portugal, Slovakia, Slovenia and Turkey) joined together in an Erasmus+ international project *STEMkey – Teaching standard STEM topic with a key competence approach* (Erasmus+ 2020-I- DE01.KA203.005671, project duration: 01. 09. 2020 – 31. 08. 2023). The project aimed to create a modular system for undergraduate preparation of teacher trainees to apply the conception of STEM education with a focus on reflection of the key competencies development as it has been required by the document of the Council of the European Union approved in 2018 *Council Recommendation of 22 May 2018 on key competences for lifelong learning* (EU Council, 2018).

Teacher trainees are the primary target group for developing the relevant materials. The secondary target group for the education of which the created teaching materials can be used are in-service teachers (use of the created teaching materials within the further education of teachers from practice). In total, 11 were created 11 modules, of which two dealt with a topic dominantly related to one of the subjects of mathematics, biology, chemistry, physics, and technology, and one is devoted to informatics or information technologies. However, the topics are always presented in a broader context of all STEM subjects. The topics of the two modules devoted to technology are *Water distribution and its purification* and *Household appliances*.

Within the module *Water Distribution and its Purification*, water is presented not only as a substance necessary for our lives or as a precondition of every kind of life (life of mankind, animals, vegetation) but also in a broader context as a technical material. Specification of the activities included in the module is presented on the flowchart of the module in Figure 1.

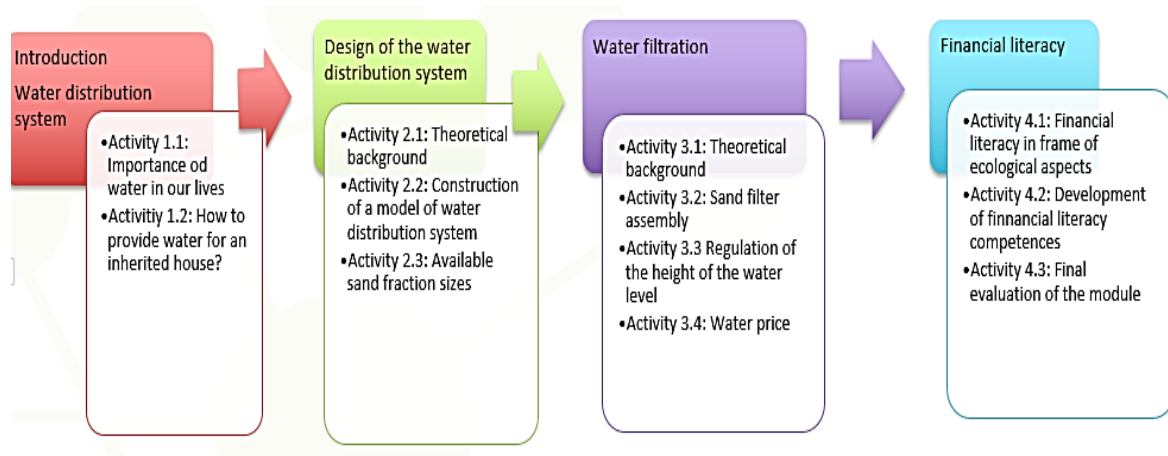


Figure 1: Flowchart of the module Water distribution and its purification.

Learning outputs, which should be achieved in the frame of this module, can be categorised in the next four issues as follows:

- *central general teaching aid*: understanding of the water importance for human life, demonstration of the water distribution system,
- *cognitive aims*: identification of the essential components of the water distribution system, description of the water distribution system in a flat, description of filtration principles
- *psychomotor aims*: assembly of a model of the water distribution system, adjustment of the water circulation in the water distribution model,
- *affective aims*: presentation of own opinions and experiences with the given topic, enhancement of own patience and precision in practical activities, development of the awareness related to the costs of water distribution and consumption, and the water sources protection need.

The module *Household Appliances* introduces engineering as a mindset and a way of doing something. Therefore, the primary attention within the module, as shown in the flowchart of the module in Figure 2, is paid to the understanding and development of the engineering mindset and engineering practices. Engineering practices for engineering design models are used to design, build and market one's own prototypes, either of a vacuum cleaner, a hair dryer, or a blender.

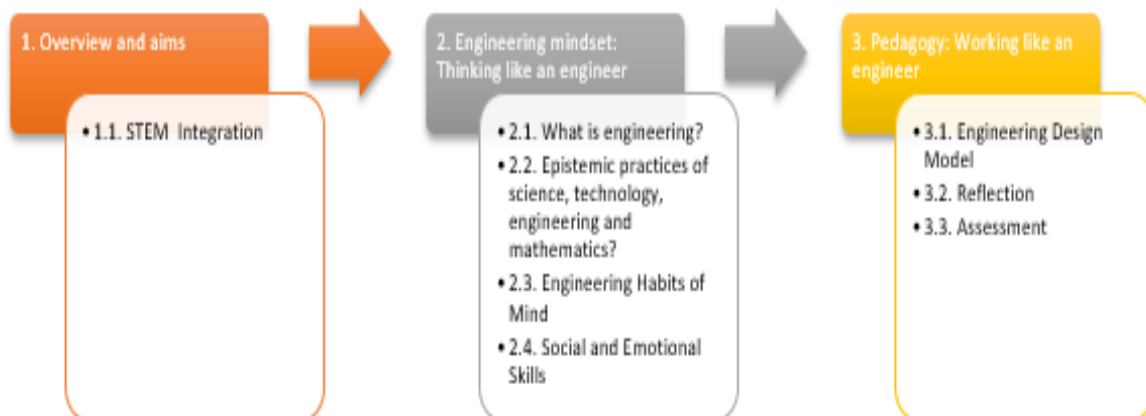


Figure 2: Flowchart of the module Household Appliances

Principal learning outputs, which should be achieved in the frame of this module, can be summarised in the following points:

- to understand the epistemological identities, relationships, and distinctions among science, technology, engineering, and mathematics,
- to learn to solve problems by developing and improving technology,
- to learn to apply engineering design model, a possess for solving problems, as they iteratively work towards generating creative solutions to a challenging problem and work like engineers,
- to allow the teacher trainees to reflect on what they have done and how the engineers work.

4 Conclusion

As it has resulted from the pilot verification of the modules developed within the project STEMkey, teaching standard STEM topics with a key competence approach to implementing STEM education in schools is, on the one hand, desirable. However, on the other hand, it relates to different obstacles. As the most significant can be stated, it is impossible to implement interdisciplinarity of the STEM education conception until the teacher trainees (as well as in-service teachers) acquire a thorough knowledge of the disciplines in which the integration takes place. This relates to a need for practical experiences, particularly in implementing inquiry and problem-solving-based activities. These experiences can be gained by the teacher trainees (or in-service teachers) during a variety of exercises, through independent work in special classes, as well as through implementation of project activities during the training, which encourages them to think about the world around them as well as about the problems related to their learning. Besides that, it is also vital to ensure the teacher trainees an appropriate environment supporting their socialisation and allowing them to compare themselves with their colleagues (classmates). As the pilot verification of the created

teaching materials showed, the effectiveness of the teacher trainees' training depends entirely on the level of formation of its value-motivational sphere. Therefore, there is a need to create appropriate motivational teaching materials, stimulating their psychological readiness to learn as well as forming their active and positive attitudes to implementing the conception of STEM education into the teaching activities they perform in the future.

Acknowledgements

The work was created with the support of the Science Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic under project No. VEGA 1/0213/23.

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Development of key competences of students in the subject of technology in primary schools

Daniel Kučerka¹, Michal Mrázek², Lucia Morovičová³, Monika Kučerková⁴

DOI: <https://doi.org/10.53349/resource.2024.is1.a1248>

Abstract

In the first part, the aim of the contribution was to direct the reader's attention to the issue of key competences, to present the basic documents of the governments of the Czech and Slovak Republics. In the second part, the authors focus on the development of key competences in the subject of technology in the 5th-9th grade of primary schools and show examples of pupils' products in the teaching process. The final part presents the procedure for verifying the research instrument in the 1st stage of the research carried out on a narrower sample of respondents. At the same time, I present some principles of the design of the research tool in the context of the upcoming international research on key competences with a focus on the current state and conditions of skill development in the subject Technology from the perspective of elementary school students. . The preliminary results of the questionnaire itself brought us some expected results that document the current state of the issue of skill development in the subject of Technology. The conducted research fulfilled the main goal, i.e. the verification of the research tool.

Keywords: Key competences, Mentor, Technics, Research tool

1 Introduction

Our society is undergoing constant changes, and this also applies to education. The demands of employers, who demand additional competencies from employees, are also undergoing constant changes. For the employee, these competencies are unknown and at the same time

¹ Palacký University Olomouc, Křížkovského 511/8, CZ-779 00 Olomouc.

E-mail: daniel.kucerka@upol.cz

² Palacký University Olomouc, Křížkovského 511/8, CZ-779 00 Olomouc.

E-mail: michal.mrazek@upol.cz

³ Primary School of Gejza Dusík Galanta, Mierová ulica 1454/10, 924 01 Galanta.

⁴ Secondary vocational school of electrics Trnava, Sibírska1, 917 01 Trnava.

require a great change, flexibility and patience when learning something new, sometimes unknown. These problems need to be solved creatively with knowledge of often professional matters from other areas, or expertise with digital competences and language equipment. Pedagogical staff, especially school management, are also faced with such challenges.

In September 2020, the European Commission adopted the Digital Education Action Plan, where it aims to create a European educational space by 2025.

Our labor market needs a lot of high-quality experts in technical fields, and the biggest problem is with craftsmen, who are massively disappearing from the labor market. SOŠ and OU have again begun to adapt to the labor market and the needs of society. Our common goal is to raise good experts and technicians, and for this we also need good teachers not only of theory, but also of practice, and above all to get good experts and experienced technicians into education for the department, so that students receive knowledge, experience and skills from practice (Kučerka, 2021).

The above-mentioned goal requires competent teachers with the necessary pedagogical and didactic competences, able to prepare students - future technical experts and craftsmen for technical practice.

2 Key competences

The concept of competence began to be used in pedagogy in connection with the analysis and change of the contents and goals of (school) education in European school systems. Changes in pedagogical terminology are in line with European developments. Education reflects social demands in a new level and quality of education. The importance of the quality of education is very important in primary and secondary schools, where basic knowledge is based on key competencies (Vetešku, 2010).

The Czech Republic lists the key competences in the National Program for the Development of Education as learn to know - how to learn, apply, evaluate learn to act and live together - in teams, communicate and learn to be - know how to orient yourself, act autonomously, value orientation, lead a fulfilling life.

An important strategic document in Slovakia valid since 2017 is Learning Slovakia, which, in addition to higher education, also discusses education and training in regional education in the following areas:

1. Quality and availability of education and training
2. Teacher profession
3. Vocational education and training
4. Management and financing of regional education

The most important skills needed for the 21st century in the world's 500 most successful organizations are teamwork, problem solving. interpersonal skills, oral communication, listening, personal and career development, creative thinking, leadership, goal setting, writing, organizational development (Longworth – Davies 1996 in Turek, 2010).

Professional competences and their components are defined as a complex set of certain dispositions and skills of a teacher, which is composed of partial or special competences. lists the following components of professional (professional) competences:

- professional subject competences (scientific foundations of the given subjects),
- psychodidactic competences,
- communication skills,
- organizational and management competences,
- diagnostic and interventional competences,
- advisory and consulting competences (especially towards parents),
- competence of reflection on one's own activity (Kalhous, Z., Obst, O., 2003).

In recent times, communication competences, professional-pedagogical competences, interpretation competences, interaction competences, assertive competences, cooperative competences have been associated with the work and education requirements of a teacher. cognitive competences, didactic-methodical competences, organizational competences, information-media competences, creative-authoring competences and other competences. The original concepts of key competences are becoming outdated and outdated, humanity is facing an ecological crisis and there is a need for people to start addressing ecological problems and have the skills, attitudes and competences to do so. According to UNECE (2012), pupils' competences for sustainable development are based on teachers' competences in the field of environmental education.

The relationship between the teacher/lecturer and the students is shown to be key to success. Hrmo, Turek (2003) state that the amount, speed, scope and importance of changes in the 21st century can be characterized as so-called megatrends of social development, which will greatly influence the nature of educational processes in the context of school education. The gradual creation of regional partnerships to support the implementation of the principles and goals of the new basic education curriculum through the establishment of regional centers to support teachers and to support the professional training of pedagogical leaders in the regions and to ensure support for teachers in the regions during the implementation of the new curriculum contributes to the development of the key competences of teachers for the 21st century. basic education in the form of mentoring and counseling.

According to the "Recovery and Resilience Plan of the Slovak Republic", 40 regional centers are to be created, which will provide support to schools through mentoring, counseling and consulting activities. As of the 2023/2024 school year, a total of 32 Regional Teacher Support Centers are already operating. Their primary goal is to help teachers with the transition to a new form of education after the introduction of the curriculum reform. The establishment and operation of the centers are financed from the Recovery and Resilience Plan of the Slovak Republic (Horecký, 2023).

According to Horecký (2023), the task of the regional centers is to provide colleagues - teachers in the region with individual advice and help with the transition to the new

curriculum and innovative teaching methods that follow the curriculum reform. "In this way, our goal is to support schools and the teachers themselves in the regions of the whole Slovakia in introducing changes in the content and forms of education. This will be done through mentoring, counseling and consultations, especially in priority thematic areas during the transition to the new curriculum," explains J. Horecký, Minister of Education, Science, Research and Sports of the Slovak Republic.

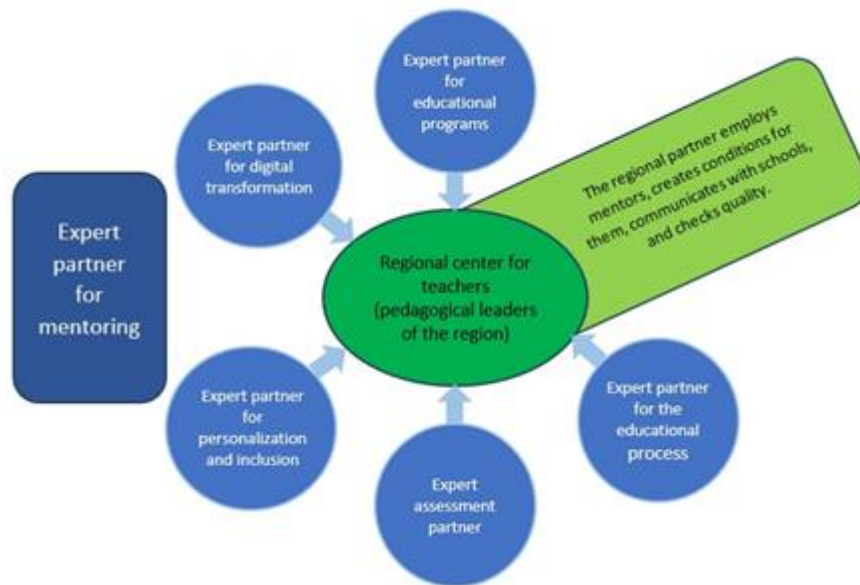


Figure 1: Ecosystem of cooperating areas (Source: Učiteľia pre 21. storočie, 2022)

The mentor should be a smart, inspiring and active teacher open to innovations in the regions, who has the potential to support other teachers in the form of monitoring. Mentors will remain active part-time school teachers (approximately 2 days a week) and the other part of the working time will be devoted to mentoring activities and will be employed by regional centers / regional partners. The main tasks of the mentor, or his mandatory activities determine the job content / work performance of the mentor.

The mentor is expected to mainly (Teachers for the 21st century, 2022) provide counseling activities in schools and school facilities in a face-to-face or remote manner.

3 Development of key competences in the subject of technology

The subject of technology is taught in elementary schools in grades 5-9. Its task is the development of technical thinking, technical literacy and motor skills. At the end of the 9th year, according to the ŠVP (appendix 1), understand the role of technology in society (understanding various aspects of technology) from the point of view of economic, social,

aesthetic and moral relations, reflect on the role of technology in modern society, the importance of career values in society and implement constructive career decisions. To master the principles of design and technology activities, to master the methods and system of scientific knowledge, to form attitudes towards technology and to be able to critically evaluate one's own questions, to share one's own attitudes and opinions. At the same time, learn the principles of career planning, create a career portfolio that is based on self-knowledge and is a source of self-reflection and a basis for setting a career goal.

After finishing elementary school, the student is able to work with various materials and technologies for processing them, uses tools, accessories and tools and can make a simple sketch or drawing, design a technological procedure, implement production and evaluate objects. In pictures 3, 4, there are samples of the works of the students of ZŠ GD Galanta on the subject of technology and show the results of paper work, in fig. 5 and 6 work with wire and wood by PDF UP Olomouc students and fig. 7th and 8th results of work on the 3D printer of SPŠSS Tábor pupils. These works point to the responsible work of pupils and students and at the same time to the erudition of teachers.



Fig. 3: Plastic technology models



Fig. 4 Paper models (archive of authors)
(Source: archive of authors)



Fig. 5 Wire model (archive of authors)



Fig. 6 Wood models (archive of authors)

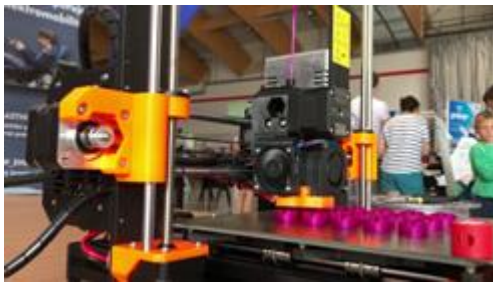


Fig. 7 Detail of the print head of the 3D printer (archive of authors)



Fig. 8 Mechanical parts of the robotic arm

4 Research methodology

As long as the development of key competences in education is not currently explicitly determined at the level of the state-guaranteed curriculum and the educational outputs set by it - standards and specific literacy (State educational program for basic education, 2023), we can start from a comparative comparison and identification of key competences (Meseşan, & Albulescu, 2020) with the mentioned educational outputs.

Until now, the area of competence research in connection with the development of skills in the subject of technology is a marginal matter that is not systematically addressed in favor of branch didactics and practice itself. As documented by the above-mentioned examples of the development of key competences in the subject of technology across all levels of education, we can assume that pupils and then students develop their technical skills and thus the necessary competences in schools. From a few examples, however, it is not possible to draw conclusions that the current educational reality is perceived in this way in all schools at the same level in terms of the optional diversity of educational content set by the curriculum with regard to the possibilities of individual schools (material conditions, personnel conditions). That is why we decided to initiate activities aimed at researching key competences in the subject of technology on a national and international scale.

In order to research the key competences of primary school pupils in the subject of Technology, we decided to carry out a partial research investigation, which aims to analyze the current state and conditions of skill development from the point of view, respectively the

opinions of pupils of the 8th and 9th grades in the subject of Technology. The proposed research design is conceived in accordance with the methodology of quantitative pedagogical research (Gavora, Chráska) and due to the extensiveness of the problem solved, it is divided into several interconnected stages on a national and international scale. The aim of this contribution is to present the proposed research tool together with its verification in practice and providing the first indicative results.

To solve the sub-part of the research, we set the following research questions:

Did the pupils learn to work with technical materials?

With which materials did the work motivate them the most?

Did the pupils learn to work with tools, tools and accessories (saw, file, scissors)?

Did the students learn to work according to the work procedure or instructions?

Did the students learn to read a simple technical drawing, make and assemble parts?

Do the pupils relate to the subject of technology (technical education, work-based teaching)?

Did the students learn to design simple products?

Did the students learn to make the designed product?

Have the pupils developed their creative skills?

What do students find difficult in the subject of technics?

What do students consider simple in the subject of technics?

Which environment motivates students the most in the subject of technics?

Which activity do the students consider the most popular?

Research tool – semi-structured questionnaire

A semi-structured questionnaire was chosen as the main research method, which is mainly based on the intention of statistically analyzing quantitatively constructed items, but at the same time, qualitative variants of items with the option of open or supplementary answers were incorporated. The main part of the questionnaire consists of 14 items. The typology of items is mixed. Included are scaled items (SI), closed multiple choice items (CMI), closed items with open-ended options (COI), open-ended items (OI).

Item type	Frequency
SI – scale items	7
SOI – scale item with open answer	2
CMI – closed item with multiple choice	2
COI – closed item with open answer	1
OI – open item	2

The scale items of the questionnaire were set as 5 levels. The individual scale levels are listed in the following table 1.

Table 1

1 definitely yes	2 rather yes	3 I can't judge	4 probably not	5 definitely not
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Validity of questionnaire items

The construction of the questionnaire items was based on the established research questions. When constructing the items, internal and external validity were taken into account in connection with the considered validity of the research and the interpretation of the results. Further, item modifications were conditional on content and construct validity. In order to get as close as possible to the validity of the questionnaire, the following criteria for the construction of the items were established:

1. Comprehensibility of items for the age category of pupils.
2. Validity of the content of the polled items.
3. Measurability by the selected type of items.
4. Unambiguity of wording of items.

The construction of the questionnaire in terms of validity took place in 3 stages. In the first stage, 7 scientists involved in the construction of the questionnaire participated in the field of education of future teachers of technology and work education in elementary schools. From the point of view of nationality, this research team consisted of 5 experts of Czech nationality and 2 experts of Slovak nationality. In the second stage, the questionnaire was put into practice to teachers of specific subjects, who gave qualitative comments on the questionnaire. In this contribution, they are the same teachers who subsequently mediated the verification of the questionnaire with the pupils. Before the actual verification of the questionnaires with the pupils took place, the 3rd stage of the construction of the questionnaire took place again on the part of the scientific workers, who incorporated the practical comments of teachers from practice.

Characteristics of the research sample

4 elementary schools from two regions were selected for verification (table 2). These were two schools from the Bratislava region (ZŠ Bernolákovo, ZŠ Ivánka při Dunaji) and two schools from the region Trnava (ZŠ SNP Galanta, ZŠ Gejzu Dusíka Galanta). The choice of schools and thus of the respondents was not completely random, therefore we did not set ourselves the goal of achieving representativeness of the research sample. 384 respondents - pupils of the 8th and 9th grades - took part in the verification. The original intention and assumption was to reach the number of 400 respondents. The return rate of questionnaires was 96%, which was caused by the distribution of printed questionnaires directly to schools. Only 376 questionnaires were evaluated, as some questionnaires were filled in incompletely or incorrectly.

Table 2

School	Numbers of pupils involved	
	Absolute frequency	Relative frequency [%]
ZŠ Bernolákovo	80	21,28
ZŠ Ivánka při Dunaji	104	27,66
ZŠ SNP Galanta	102	27,13
ZŠ Gejzu Dusíka Galanta	90	23,94

Results of questionnaire verification in Slovakia

McDonald's ω was chosen to calculate reliability. In order to increase reliability, the Greatest lower bound (GLB) test was performed, which is suitable for determining the reliability of a questionnaire with only one administration (Shapiro, Berge, 2000). As part of the comparison, we also present the value of Cronbach's α , which is the most used method for verifying the internal consistency of the data (Hermosilla, Alvarado, 2016).

The optimal value of the ω coefficient is 0.7 or greater (Akhkand et al, 2021; Xiaoli Ni et al, 2020). The value of $\omega = 0.844$ found by us is optimal, and taking into account the value of GLB > 0.8 (GLB = 0.843), we accept the reliability as sufficient when using a non-standardized questionnaire. Statistical data processing was carried out using Statistica and JASP statistical software.

Reliability Analysis

Scale Reliability Statistics

	McDonald's ω	Cronbach's α	Greatest lower bound
scale	0.844	0.881	0.843

Note. Of the observations, 376 were used.

When evaluating the data, we did not make any assumptions within the framework of this (pre)research that we would like to accept or reject based on statistical testing. The primary aim was to verify the created research tool. We perceive the results below in the form of statements as indicative and are for us a starting point of information for data processing within the main stage of the research that will follow. The stated claims are statistically verified at the $\alpha = 0.05$ significance level using a paired T-test. For an objective assessment of possible relationships between variables, a correlation matrix was additionally performed with Pearson's r calculation. Significant relationships were identified at the significance level $\alpha = 0.05$.

Pupils can work relatively well with paper and wood. At the same time, students would like to work with paper and wood most often.

The students learned to work with paper a little better than with wood, but if they could choose, they would rather work more with wood than with paper. The said preference is statistically significant.

The students are the worst at working with metals and glass, but they also don't want to work too much with these materials.

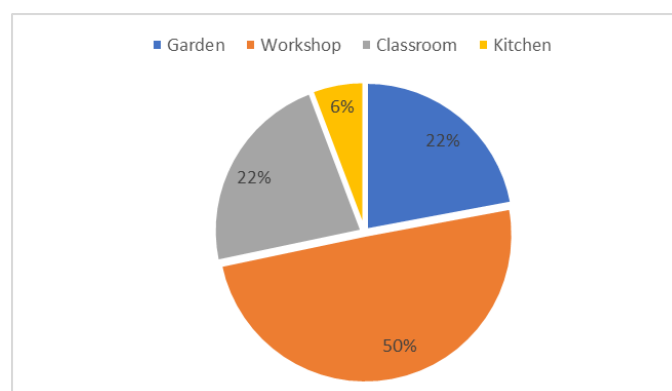
The pupils learned to work with glass the hardest and metal slightly better. In the case of the possibility of choosing the material for the work, glass would be the least preferred. Metals would not bother the students as much for work, as the slightly less preferred plastics. Pupils have learned to work better according to instructions, but it is more difficult for them to make a product according to their own design.

The result is not so surprising, because students should first learn the skills according to instructions, instructional procedures and proven methods. Only then can they apply and further develop the skills in creative and creative tasks.

The relationship between what students want to learn and what they have learned. The correlation matrix pointed to possible relationships on two levels. At the first level, there are numerous relatively stronger relationships between the views of what materials the students have learned to work with and what they would most like to work with. Both positive and negative links apply here. On the second level, weaker correlations can be observed between the opinions of which materials the students have learned to work with, or with which they would like to work, and whether they think they can work according to instructions or procedures, design a simple product and make it.

Students see less of a problem in creativity, but its materialization is already worse. Although the previous statements already indicate it, the students rather think that they are creative and have ideas, but subsequently they are not so good at materializing the idea into a design of a product that they would then be able to make. Above all, there is a relatively strong relationship between designing and manufacturing the product. Pupils consider designing a product to be more challenging.

Approximately half of the pupils go to school workshops. Half of the pupils prefer working in the workshop (graph 1). In this case, a frequency analysis was performed and the results are presented graphically in percentages.

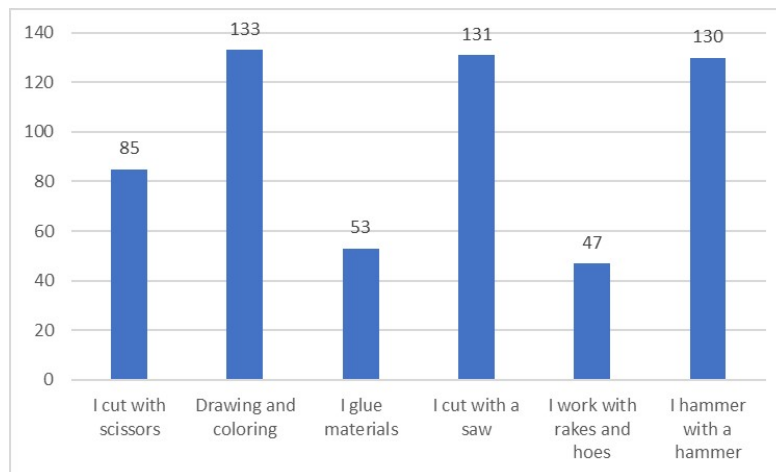


Graph 1

Although the statement sounds very encouraging, only a quarter of all pupils go to the school workshop regularly. The remaining part of the pupils also develop their skills in the workshops, but a maximum of 3 times per semester. On the contrary, almost half of the pupils do not go to school workshops at all. We assume that this phenomenon will not change during the main research stage. In our opinion, the explanation corresponds to the current form of the established curriculum.

The most popular activities are: drawing and coloring, sawing and hammering (graph 2)

The mentioned three activities significantly dominate with an almost identical frequency over the other activities. As part of the open-ended answers, the pupils also added activities such as: sawing, cooking, working with textiles or drilling. The frequency of added activities is on the order of dozens. Cooking was mentioned the most (32 pupils). In this case, a frequency analysis was performed and the results are presented graphically with specific frequencies.



Graph 2

5 Discussion and conclusion

The aim of the paper was to present the procedure for verifying the research instrument in the 1st stage of the research, implemented on a narrower sample of respondents. At the same time, some principles of the design of the research tool were presented in the context of the planned international research on key competences with a focus on the current state and conditions of skill development in the subject Technology from the perspective of primary school pupils.

Validity was addressed during the construction of the questionnaire in 3 stages. A possible comparison of the research instrument with alternative researches was not possible for the analysis of criterion validity, as we did not find any relevantly similar research in terms of content and construction. In order to accept the validity of the questionnaire as sufficient, it

was therefore necessary to check the agreement between the results and the purpose for which the questionnaire was created (Schindler, 2006).

Although the possibilities of verification are very limited, at the level of assessment of the results by experts, it turned out that the items of the questionnaire ask about what the intention of the research is to find out. At the same time, it turned out that the questionnaire items are asked correctly. Pupils understand the items and are able to answer them. This fact is also confirmed by the reliability test. McDonald's value $\omega = 0.844$ is sufficient for us in the initial measurement in comparison with the critical value $\omega = 0.7$, which is commonly used in research (Akhkand et al, 2021; Xiaoli Ni et al, 2020).

Alternative reliability coefficients do not contradict the result. During the analysis of the partial weights of individual items in favor of overall reliability, no item was identified that would significantly influence the decrease of overall reliability. It is therefore not necessary to eliminate items from the questionnaire or to fundamentally reformulate them. From the above, we consider the questionnaire sufficiently valid and reliable for use within the main stage of the research.

The preliminary results of the questionnaire itself brought us some expected results that document the current state of the issue of skill development in the subject of Technology. Work with technical materials such as paper and wood dominates the foreground. On the contrary, materials such as metal or glass are mostly left behind. It has its own logic in terms of material security, availability of materials, but also the conditions and difficulty of processing. Half of the interviewed pupils express their interest in working in workshops. In reality, however, only a quarter of pupils will visit the workshops at schools. This finding is very similar to the results of research 10 years ago (Pavelka, 2013), when less than a quarter of the schools surveyed implemented teaching in school workshops.

However, the conducted research also indicated interesting results, which will be desirable to verify. Although the students expressed in their statements the relationships between the implemented and preferred teaching content. A possible trend was also revealed, which points to a relatively positive self-evaluative view of pupils on their own creative abilities, but a lack of competence to translate a creative idea into a concrete level of implementation.

The conducted research fulfilled the main goal, i.e. the verification of the research tool. At the same time, he provided us with valuable information that opens up space for questions for the main research not only at the level of finding answers, but above all verifying their validity and comparing them on an international scale.

Acknowledgments

The paper was supported by the following project: GDF_PdF_2023_03 - Development of key competences through the use of didactic tools of technical education teacher - teacher 21

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Virtual Excursions in Vocational Education and Training

Peter Kuna¹, Alena Hašková², Ľuboš Borza³

DOI: <https://doi.org/10.53349/resource.2024.is1.a1249>

Abstract

In connection with the rapid development of modern means of communication, there is also a very rapid development of technologies using virtual reality as either a means of entertainment or modern education. The article discusses the possibilities of using virtual education or education based on the use of virtual reality in general. However, the primary attention is paid to analysing the use of virtual reality in the secondary vocational school environment. Additionally, it presents a concept of a virtual excursion aimed at the automated production process of processing aluminium profiles for the automotive industry.

Keywords: Virtual reality, Virtual Excursion, Vocational education and training

1 Introduction

Virtual excursions represent a dynamic evolution in education in general. However, they are an essential means of education, mainly concerning technical education and, specifically, for vocational education and training. The stated results are from the fact that they provide students with immersive and interactive experiences that transcend the boundaries of traditional learning. As the progress of technologies continues to advance, the potential of virtual education applications in vocational education and training is more and more vast and promising. Virtual excursions presenting manufacturing processes offer a unique and valuable opportunity for students to delve into the intricate world of industry without any constraints

¹Faculty of Natural Sciences and Informatics, Constantine the Philosopher University, Tr. A. Hlinkuk 1, 949 01 Nitra, Slovakia.

E-mail: pkuna2@ukf.sk

² Faculty of Education, Constantine the Philosopher University, Dražovská 4, 949 01 Nitra, Slovakia.

E-mail: ahaskova@ukf.sk

³Faculty of Education, Constantine the Philosopher University, Dražovská 4, 949 01 Nitra, Slovakia.

E-mail: lubos.borza@ukf.sk

of their physical location. By leveraging digital technologies, students can virtually explore manufacturing facilities, witness complex processes, and gain insights into the nuances of production. One of the primary advantages of virtual excursions in manufacturing education is the ability to showcase real-world applications. Students can virtually step onto factory floors, observe the assembly lines, and witness the manufacturing of products from raw materials to finished goods. This immersive experience enhances their understanding of the entire production lifecycle, providing context to theoretical knowledge gained in the classroom. The fact that virtual excursions allow vocational school students to get to places and see work processes that they could hardly imagine increases the attractiveness of both the teaching and learning processes and vocational training. Hereinafter, at first, the theoretical background and specifics of virtual reality are described and analysed, and consequently, then pointed out on the virtualisation of the automated production process of processing aluminium profiles for the automotive industry.

2 Virtual Reality in Education

Concerning the use of virtual reality in education, two concepts arise, the meaning of which needs to be clarified: *virtual reality* (VR) and *virtual world*.

Virtual reality is a computer technology that, through hardware and software, makes it possible to create virtual models of objective reality and use them to generate people's perceptual feelings. On the one hand, virtual reality technologies can be used to create 3D spatial models, which can be used for 3D modelling and investigating the properties of real objects. On the other hand, it is possible to use virtual reality to create a "realistic" model spatial environment in which a person can virtually "realise" the desired activities (Hodge et al., 2007).

The virtual world is, according to Bartl (2004), a world implemented by using a computer (or using a computer network) that simulates an environment. Some, but not all, objects in this environment act or are under the direct control of individual humans. Since several people can influence the same environment simultaneously, we call such worlds *shared* or *multi-user*. While no users are connected to the environment, the environment continues to exist and develop internally (at least to a certain degree).

One of the primary advantages of integrating virtual reality into education is its ability to simulate real-world scenarios. For instance, students studying history can virtually step into historical events, witness them unfold, and gain a deeper understanding of the context. Similarly, in the field of science, virtual reality allows students to explore complex concepts through realistic simulations, making abstract theories more tangible and comprehensible. Moreover, virtual reality provides a personalised learning experience. Students can progress at their own pace, revisiting concepts or areas needing additional assistance. This adaptability caters to diverse learning styles and ensures students can grasp the material thoroughly (McGrath et al., 2023).

Collaborative learning is another dimension that virtual reality brings to education. Students from different locations can connect in a shared virtual space, fostering collaboration and teamwork. This prepares them for the collaborative nature of the modern workforce and promotes cultural exchange and understanding.

In 2015, Freina and Ott conducted a review study of what research was being done in 2013 and 2014 regarding the use of virtual reality in education. They found that 93 different studies were conducted in these years, with a decreasing trend over time, and the most significant number were conducted in the United States. Most of the research was related to using virtual reality in higher education, universities, and adult training. Only one was related to the use of virtual reality by children. The applications appearing in individual research were most often focused on the field of healthcare, medicine, and specific professional training for adults, in which, for example, situations that could be dangerous in reality were simulated. Based on their research, Freina and Ott (2015) have thought that the convenience of simulating dangerous or otherwise tricky, inaccessible situations was also the most common motivation for most research.

In addition to traditional subjects, virtual reality is making a significant impact on vocational training. Simulations in virtual reality enable students to practice and refine practical skills in a risk-free environment. This is particularly valuable in fields such as medicine, where students can perform virtual surgeries, or in aviation, where pilot trainees can undergo realistic flight training.

However, despite its potential, the widespread adoption of virtual reality in education faces challenges such as cost, technological barriers, and the need for specialised training for educators. Overcoming these obstacles will be crucial in unlocking the full potential of virtual reality as an educational tool. As technology advances, the integration of virtual reality in education is likely to become more commonplace, offering students an innovative and effective way to learn, explore, and interact with the world around them. The immersive nature of virtual reality has the potential to transform education into a more engaging and personalised experience, preparing students for the challenges of the future (Bao et al., 2016).

3 Virtual excursions in Education

Virtual excursions in education have emerged as a transformative and innovative way to broaden students' horizons beyond the confines of traditional classrooms. Leveraging the power of technology, virtual excursions enable students to embark on immersive journeys to destinations worldwide without leaving the comfort of their schools or homes (Kavanagh et al., 2017).

One of the key advantages of virtual excursions is their ability to break down geographical barriers. Students can visit historic landmarks, explore cultural heritage sites, or delve into the depths of ecosystems that may be otherwise inaccessible. This enhances their understanding

of various subjects and fosters a sense of global awareness and interconnectedness (Christou, 2010).

The interactive nature of virtual excursions engages students in the assigned activities in a way that textbooks and lectures often cannot. Through virtual reality (VR) or augmented reality (AR) platforms, students can actively participate in simulations and educational games that make learning both enjoyable and memorable. For example, they can virtually dissect a frog in biology class, visit ancient civilisations in history, or explore the cosmos in astronomy. Furthermore, virtual excursions provide opportunities for real-time collaboration and interaction. Students can connect with experts, scientists, or guides who offer insights and answer questions, creating a dynamic and personalised learning experience. This collaborative aspect facilitates knowledge transfer and supports the development of their critical thinking and problem-solving skills.

Inclusive education is another area where virtual excursions can significantly support learning goals. Students with physical disabilities or those in remote locations can participate in these experiences on an equal footing with their peers. This inclusivity promotes diversity and ensures all students have access to a rich and varied educational experience (Fineman, 2017).

Those who play a crucial role in integrating virtual excursions into the curricula are teachers (educators). They can curate content, design learning activities, and facilitate discussions that align with the curriculum objectives. Additionally, teachers can use virtual excursions to spark curiosity, encouraging students to ask questions and explore topics independently. While virtual excursions offer numerous benefits, it is essential to strike a balance with traditional teaching methods. They should complement, not replace, face-to-face interactions and hands-on experiences. Moreover, considerations for the ethical use of technology, data privacy, and ensuring a safe online environment must be prioritised.

Virtual reality (VR) or augmented reality (AR) can simulate hands-on experiences, allowing students to virtually interact with machinery and equipment. This not only aids in visualising abstract concepts but also serves as a safe and controlled environment for learning about potentially hazardous processes. For instance, students can explore welding techniques, understand CNC machining, or witness quality control procedures. Collaboration and engagement are crucial aspects of virtual excursions in manufacturing education. Students can participate in virtual tours led by industry experts, engage in live Q&A sessions, and even collaborate on virtual projects. This exposure to real-world professionals provides valuable insights into industry practices, challenges, and innovation, fostering a bridge between academic knowledge and practical application. Moreover, virtual excursions open up possibilities for global connections. Students can explore manufacturing facilities worldwide, gaining an appreciation for diverse approaches to production processes and global industry standards. This global perspective is particularly relevant in a world where manufacturing is often an interconnected and international endeavour (Hashemipour et al., 2011)

4 Implementating Virtual Excursions into the Teaching Process

Virtual excursions are an innovative approach to learning that allows students to delve into various topics without leaving the classroom. Using virtual excursions, schools, mainly vocational schools, have a valuable tool for enriching the learning environment and evoking students' interest in learning and vocational training. Implementation of virtual excursions in teaching should follow the given steps (McGrath et al., 2023):

1. Identification of learning objectives:

- Identification of subjects or topics that could benefit from virtual field excursions.
- Defining educational goals that could be achieved through virtual excursions.

2. Selection of virtual excursions:

- Exploring existing virtual excursions or platforms that offer relevant content to the given educational needs.
- Selecting content relevant to the student's program and learning standards.

3. Technical preparation:

- Ensuring access to the necessary technical infrastructure, including computers, internet, and other devices (virtual reality headsets).
- Ensuring teachers and technical staff know the necessary technology (Pavera, 2023).

4. Training of teachers and students:

- Instructing teachers on how to integrate virtual excursions into teaching.
- Ensuring that students are familiar with the use of the virtual technology.

5. Integration the virtual excursion into the teaching process:

- Designing lesson plans that include virtual field trips and are included in the curriculum.
- Discussions and student questions to ensure active involvement in the virtual excursions.

6. Monitoring and evaluation

- Development of an evaluation method for measuring the impact of the virtual excursions on the students' learning processes.

7. Maintenance of interest:

- Diverse virtual excursions that relate to different subjects and interests of students.
- Ensure that virtual field trips are relevant and up to date.

8. Consideration of safety:

- Virtual excursions and their technology use comply with safety and ethical standards.
- Guiding the safe use of technology, including time limits on exposure to virtual content.

9. Feedback from students and teachers:

- Obtaining feedback from students and teachers regarding experiences with virtual field trips.
- Adapting the implementation based on feedback.

10. Sharing experience:

- Sharing projects created thanks to virtual excursions with other teachers and schools.
- Creating a community where educators can inspire each other and share best practices (Šmidák, (2017).

11. Update and extension:

- Regularly updating the content of the virtual tours to keep it current and relevant.
- Extending virtual excursions to other subjects or grades (Virvou et al., 2005).

5 Creation of a Virtual Excursion in Automotive Industry

We intend to create a virtual excursion focused on the automated production process of processing aluminium profiles for the automotive industry. Potential usability of this teaching aid is within secondary vocational schools offering, e.g. such study branches as mechanic, mechatronic or metal worker (dealing with machining and processing of metals).

The main task of this excursion is to completely immerse students in the production process, which will enrich them with valuable information and enable them to gain innovative knowledge of the given field. The virtual excursion simulates the individual steps of the production process with precise descriptions, from the initial storage of raw material to the final product of aluminium profiles. Through this simulation, students can easily reach places not directly accessible in production. The virtual excursion helps to get an insight into the working spaces focused on welding, pressing, and milling, followed by the study fields of secondary vocational schools. The last but not most minor advantage of virtual excursions is usability for students from the comfort of home and students with special educational needs who are physically challenged. A secondary possibility of using the virtual excursion is its use for different companies to train and familiarise their new employees with the working environment and working processes they will be involved in (Walsh, K. 2017).

To create a virtual excursion, it is necessary to have the appropriate equipment capable of achieving all the necessary steps. The first is the camera with which we will capture the environment suitable for a virtual excursion. Here, we have two creation options. The first is the creation of photos that will be connected into whole sections in later post-production, which allows us to move freely in the virtual space. The second option is short spherical video sections that introduce the user, in our case, students, to the virtual environment of the real world. Our goal is to create a virtual excursion serving high school students for a better idea of the work processes taking place during a company's production for the processing of aluminium profiles. Our previous experience of creating virtual excursions has proven that we create individual exposures from 20 to 30-second shots. Images taken in closed spaces,

including production halls and industrial lines, require the correct setting of ISO values on the camera due to poor artificial lighting and excessive distortion of dark places in these spaces. The beginning of the virtual excursion is the stocking of the material needed for production, called the input factors of the production process (Osman & Ismail, 2009).

A large number of these manufacturing processes are automated processes. Transfer aluminium columns to a considerable storage tank, where they wait to be cut to the required size and subsequent transport to a massive sheet that heats these cuttings and adapts them to the necessary profiles. Footage of scraps and scraps used in the recycling process and automated lines for safe transfer or preparation for export of the final product is recorded in our virtual excursion in 4K resolution. The height of the camera placement is also important; it should match the average height of an adult for a better visual effect. The camera, equipped with two 180° sensors, cannot have any obstacle in the angle of the shot to take full-value shots (Liu et al., 2017).

The prohibition of entry for persons limits some areas of the production process. We can capture these spaces and transfer them to our virtual excursion for a better idea for the student. The camera we used to make our virtual excursion is equipped with WIFI and a reliable mobile application with which we can check all settings and the camera's position before recording the premises. During the recording, it is necessary to follow all the safety instructions of the company or enterprise in which the recording is carried out. For the correct timing of shots during production, we must observe the accuracy of moving the camera every 4-6 meters. This distance allows us to connect shots due to focusing the camera at this distance. The recording is saved directly to the device's memory card or to the mobile phone, depending on what the user prefers. Moving the images to the computer and then using the Adobe Premiere PRO program allows us to edit and work with them, thanks to almost unlimited possibilities (Palmer & Williamson, 2017).

In this part of the editing, we can fine-tune the time interface of the sections and adjust the colourisation of these sections, which is essential for the final effect. After careful consideration, we define titles or descriptions for the individual points of the sections. In the meantime, metadata must be processed to properly combine the shots of both camera lenses. The entire processing of the virtual excursion must be of the highest possible quality so there are no imperfections, errors, or defects in the final state. Faulty data transfers between the camera, mobile device or computer often cause these errors. Video export takes place under the H.265 video standard, which has the necessary codec for playing these videos. We want to upgrade to 8K resolution and processing in the new H.266 standard. However, nothing ends with the export of our virtual excursion. Among the many available players and systems that will allow us an irreplaceable experience from a virtual excursion, we will limit ourselves to a minimum due to the charging of these platforms. YouTube is, therefore, also our choice from the point of view of sharing the excursion among students, even though recently, the conditions of use of this platform have rapidly changed to the disadvantage of the creators (Tse et al., 2017).

A big advantage is that this platform allows us to use a virtual excursion in a mobile device, in a virtual reality headset, and in laptops and tablets. This is an irreplaceable advantage for students regarding usability, whether regarding the equipment used or where they will want to participate in the virtual excursion. However, everything depends on the internet connection. This undemanding equipment suits schools and companies that want to train their employees. (Meta Quest Blog, 2021).

6 Conclusion

Virtual excursions offer a broad range of possibilities to enhance vocational education and training as students can, through them, be "involved" in different industrial and manufacturing processes, and they have a chance to observe and experience them. Although we are aware of the negatives connected with the creation and use of these didactic means (such as the high financial costs of the relevant hardware and software, the necessity to train the staff, problems with "lack of reality", possible students' suffering from motion sickness), we believe that soon virtual reality technologies will be accepted into the educational processes at almost all levels and kinds of schools.

Acknowledgements

The work was created with the support of the Cultural and Educational Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic under project No. KEGA009UKF-4/2023.

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Infiltration of artificial intelligence in education

Tatiana Kutíš¹, Kristína Žilínková²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1250>

Abstract

The economic sophistication of countries, technological advancements, and the influence of social networks and the media on our lives all accelerate the development of artificial intelligence (AI), which is gradually becoming established in everyday life. Through applied research, we try to point out how easy it is to use AI in the student's life when processing school assignments, with the fact that the quality of the output is sometimes indistinguishable from real students' written work. The initial results of this study show that AI-created works within general education subjects are almost indistinguishable from students' works and also suggest that teachers' recognition of AI-created works is more complex than expected and thus opened a discussion on the importance of comprehensive education and support of teachers.

Keywords: Education, Artificial intelligence, AI, ChatGPT

1 Introduction

The gradual digitisation of society, the accelerator of which was COVID-19, brings many positive aspects, but it also has its opposing sides. The positives of the rapid pace of technical networking and digitisation penetrating education are also points of interest in foreign literature. Many authors in the scientific community dedicate their work and create space for this modern and vibrant field of education, where new, high-quality research and information are constantly being added. The dizzying pace of digitisation brings various pitfalls with it. In general, the COVID-19 pandemic and the introduction of distance education revealed a low level of knowledge and skills in the information technology environment among teachers and a low level of adaptation to the new digital environment and technical networking.

The technical advances and affordability of personal computers, the introduction of the internet into the working life of teachers, a large amount of data and the synergistic effects of

¹ DTI University, Ul. Sládkovičova533/20, SK–018 41 Dubnica nad Váhom, Slovak Republic.

E-mail: kutis@dti.sk

² DTI University, Ul. Sládkovičova533/20, SK–018 41 Dubnica nad Váhom, Slovak Republic.

E-mail: zilinkova@dti.sk

networking all enabled the rapid and widespread use of artificial intelligence in the everyday life of ordinary citizens. Above all, young people and students are inclined towards technologies and technical innovations with enthusiasm and with the vision of making their work easier, simplifying their lives and adding more fun or free time. As we know, the student is comfortable by nature, and it is then that he becomes more innovative in the use of various techniques that will help him facilitate the fulfilment of school duties or assignments and often begins to reach for the use of other tools and aids, such as artificial intelligence. Thanks to this, artificial intelligence is constantly advancing and improving. Artificial intelligence often intervenes in student work without the knowledge of teachers, thereby distorting the objectivity of the evaluation of written student speech, as evidenced by many personal experiences in long-term distance education.

With a low level of knowledge about the possibilities of working with technologies and artificial intelligence, it is very difficult for the teacher to check the plausibility and originality of submitted works. The only options for minimizing this are reading literacy, reading comprehension, the assumption of copying the textual aids that the teacher used as a model for the covered curriculum together with the students, and the teacher's judgment based on the knowledge of the individual cognitive competencies of individual students.

For this reason, we focused on the current experience of teachers and their level of recognition of student works from works created by artificial intelligence. We are interested in the overall infiltration of artificial intelligence into everyday education with an impact on verifying the plausibility of the originality of student-written works. In our work, we deal with the quality of written works from the point of view of the qualified teachers, the level of education achieved, the age of teachers and the length of teaching experience with the possibilities offered by artificial intelligence in the form of the ChatGPT online platform. The motivation for choosing the topic of the contribution was the secondary expansion of the ongoing research of our dissertations and, at the same time, the broadening of the personal horizons of the digital literacy of teachers regarding active pedagogical practice. From the aspects mentioned above, we formulated a research problem, a research goal based on it. For a better understanding of the complexity of the whole issue, the formulation of research hypotheses followed.

2 Artificial Intelligence

In society, we meet two groups of respondents. Some are intensively and consciously interested in any technological innovations in society. On the other hand, some do not even realise that they use artificial intelligence every day in their everyday activities. From a simple search for information using Internet search engines, through remote control of the air conditioning unit in the home using smartphones, to driving electric cars. When the phrase "artificial intelligence (AI)" is used, many people imagine very intelligent machines that are

programmed to perform various tasks and facilitate the overall physical and cognitive activity of a person in individual spheres of social life. Education is no exception.

2.1 What is Artificial Intelligence - What is the Reality?

Where do the boundaries of recognition between human work and the work of intelligent machines blur? How can one distinguish what was created by the student and what was created by artificial intelligence? Alternatively, is the young generation of students walking into a situation where they will not be able to create, for example, ordinary text-written works on their own without the help of artificial intelligence? If the students move in the direction of mutual coexistence with AI more and more, they may reach a point where they will not be able to evaluate any assigned task independently and adequately and not even be able to fulfil it to the required level. A secondary manifestation of the use of artificial intelligence is the weakening of students' cognitive abilities. "Systems with artificial intelligence can solve tasks that require human intelligence." (Kvasnička et al., 2009, p. 99).

Artificial intelligence is perceived and described by scientists in different ways based on their research. Most often, in the scientific community, we come across the definition that: "it is intelligence demonstrated by machines, as opposed to that shown by humans." It is a field of study in computer science that tries to reproduce what the human brain does." (Spano, 2019, p. 17). Many questions from the field of informatics (computer science) are still unanswered, for example, can a computer think like a human? Is the human brain and its judgment imitable? Can machines adequately replace the activity of the human brain?

2.2 Artificial Intelligence and ChatGPT

The first chatbot, "Eliza", dates to 1966. In recent years, on various websites of shops, entertainment, or state institutions, we can meet chatbots with AI in the form of Life Agents (e.g. Taxana on the website of the Financial Administration), which are supposed to answer basic questions or navigate us where we can find the answer to our question. They increase productivity and help keep the user on the site longer. In response to human questions, chatbots provide an immediate response using natural language, as if it were a human dialogue partner (Følstad, A. et al., 2017).

According to Khalil, the term "Chatbot" indicates a program that can be integrated into various platforms such as virtual assistants on websites with the main goal of simulating human conversations that work based on machine learning techniques and understanding user input and processing their natural language so that their response looks like a conversation (Khalil et al., 2023).

Chatbot technology was used by OpenAI, which created an advanced form of a new revolutionary chatbot that has advanced natural language processing and is powered by complex machine learning techniques, called ChatGPT (Chat Generative Pre-Trained Transformer). The first introduction of ChatGPT, which communicates based on written

conversation in eight languages non-dependent on each other, was at the end of November 2022. Currently, the program can communicate independently in 80 languages of the world. Its basic functionality is in imitating human conversation, but it can create a logo, program, write poems, translate, play games and more. The qualities of ChatGPT are also admirable thanks to its development taking place on more than 40 terabytes of text. If we calculated it mathematically, we could imagine approximately 40 million books in the Kindle reader (Rudolph et al., 2023).

ChatGPT is rapidly gaining popularity among the public when creating marketing texts; it is also gradually being recognised by students, who can use it to draw inspiration when writing school assignments or even to prepare a complete assignment.

The pressure exerted on teachers to be one step ahead of students and to have sufficient information about new trends in digital networking and artificial intelligence is enormous. Based on their experience and knowledge of the content and performance standards for the given subject developed by the Ministry of Education of the Slovak Republic, teachers should be able to determine that the given student acted dishonestly, and that the assignment was prepared by AI or someone else. The student's independent work should be correlated with the performance standard for the required year, the curriculum covered, as well as with the individual knowledge of the student, based on which the teacher should be able to estimate the cognitive and verbal possibilities and abilities of the given student, but also based on his motivation and activity in class.

3 The Issue of Teachers' Competences at Secondary Schools

The surrounding world offers us all a lot of information. "Knowledge - is the result of a person's cognitive activity, which he acquires through his own experience and can have a general nature (concepts, relationships, contexts...), factual nature (names and designations of specific things and phenomena), factual nature (data about facts, dates, names, etc.)" (Petlák 1999, p. 36).

We currently have educational textbooks full of "difficult" texts or complicated tasks and experiments for which the school often has neither the space nor the equipment. "Textbooks or schoolbooks contain didactic processing of the subject matter defined by the curriculum and are a basic didactic tool in implementing the educational process" (Petlák, 1997, p. 52).

For a student to advance to a higher grade, he needs to acquire knowledge, including creating written works, at the minimum required level for each educational subject. Another aspect that guides the teacher and influences the recognizability of the created text presented by the student for his/her work is based on individual knowledge of the student's cognitive abilities during student self-presentation. When creating texts, teachers use the professional terminology for the year the student is studying. Likewise, from the teacher's experience in the stylisation of sentences, their composition, and the overall cross-curricular linking of

information by students during lessons. The cohesion of the teacher's didactic experience and the level of knowledge he imparted to the students during the given subject, in combination with the individual knowledge of the students' cognitive knowledge, ultimately affects the teacher in the overall classification of the student and reading literacy as such when working with students' text works.

3.1 Pupils' Written Works and their Assessment

In pedagogical practice, we encounter situations where a student surprises the teacher in his report, essay, or composition with information from current discoveries, experiments, or tests in the given scientific field outside the content standards of the year in which the student is studying. The reason may be the easy and quick availability of any irrelevant and unverified information on the Internet, originating from various theories and conjectures. "From the point of view of personal constructivism, students begin to perceive themselves as scientists - researchers, whose ideas are formed in the same way as scientific theories" (Nováková, 2015, p. 9). If he detects an attempt to cheat and present someone else's student work as his own, he can adequately take this fact into account in the final evaluation of the student. On the other hand, pupils lack experience selecting irrelevant information from the Internet concerning their cognitive abilities.

During his work, every teacher recognises that the student's pace plays a vital role in preparing for teaching. "The basic condition for conscious work is brain activation. When explaining the learning material, the more information channels the teacher offers to his students, the easier and more permanent the new knowledge will be fixed in their brain" (Nováková, 2015, p. 10).

Petlák E. (1999) agrees and states the following in his publication: "The logical (objective) point of view means that the content of education must ensure a logical connection, continuity of acquired knowledge, abilities and skills." In doing so, one proceeds from simpler to more complex, from easier to harder, etc." (Petlák 1999, p. 56).

When reading with comprehension, students get the opportunity to develop and consolidate processes such as analysis, deduction, induction, the development of selection and comparison, or the synthesis of previously acquired knowledge with newly acquired information and skills offered by the teacher during the lesson is very important. "Understanding the structure of a topic leads to a better understanding of the whole. Such an understanding will ensure the student's inclusion of new knowledge with the previous ones" (Tomášková, 2018, p. 19).

"Attention should also be focused on solving practical tasks necessary in the student's life and enabling independent thinking. It is necessary to create a teaching environment that would engage pupils in learning experiences and enable them to think and create meaning from experiences" (Fančovičová, Prokop 2010, p. 4). Acquiring the skill of reading and writing texts is a supporting element in the development of oneself in the general and professional field of the student.

A high level of literacy is an essential tool for students and teachers. Mutual knowledge of the pupils' possibilities offers space for an objective evaluation of the pupils' written expressions. Not only a creative student can be successful in the cultivated self-presentation of his work, but also a weaker one if he is guided and supported to read and write at the right pace. "The focus of the current teaching process is that students' knowledge, skills and habits are the result of their reasoning" (Tomášková, 2018, p.13).

3.2 Reading Literacy

Text teaching aids are intended to facilitate the teacher's work in increasing the student's reading literacy and support creativity in creating their own written works. "Basic literacy is characterised by a person's ability to read and decode the meanings of what is read. Information is stored in memory and reproduced, more or less modified, as needed" (Kašiarová, 2011, p. 6).

With the increasing skill level of reading literacy, the student's ability to understand the read text, imagination and search for or perception of connections between individual subjects, phenomena and events arising from the text also develops in direct proportion to the student's increasing age and more significant, more intensive experience with reading the text. An increasing degree of understanding of the content of the read text for subsequent use in life is also essential.

In our opinion, the teacher is the mainstay of education in acquiring new vocabulary and adequately creating written works for self-presentation. This skill requires long-term preparation and a lot of energy from the teacher and the student.

"The linguistic concept is connected with scientific and every creative thinking, that is, with the process of productive knowledge. The basic operation here is conceptual generalisation (generalisation, extrapolation), by which "concepts are supplemented, corrected, or even created a new" (Pavlovič, 2012, p. 15).

The text comprises concepts with a specific goal, which the author, the pupil-teacher, wants to convey his knowledge through the text as a means of communication.

From the correctly compiled sequence of text concepts of the student and the teacher, the experience of the read text should be manifested with the awareness of the meaning of the use of information in practical life. Sometimes it is enough to acquire a feeling, an experience from the read text due to the aesthetic function of the text. The opposite case is understanding the meaning of professional terms, which leads to selection and emotionality in the professional scientific field in the expert reader.

"Today, the teaching process with an explanatory-illustrative character, in which the teacher is active, and the student is passive, is unsatisfactory" (Tomášková, 2018, p. 13).

Pupils read very little and are not interested in school textbooks or cannot read with comprehension. Some students look at pictures that do not make sense to them. A deeper meaning. They lack the adequate or paternal literacy necessary to create a text. By reading, the vocabulary is enriched, and the student gains practical experience with the correct text

stylisation, which is essential for the independent creation of written works. Such personal knowledge of the student in class is reflected in the final evaluation of the student. The more the teacher knows the students' feelings, opinions, and way of thinking and expressing, the better he knows how to comprehensively and objectively evaluate their cognitive, psychomotor, and affective possibilities. We focused our research on this essential parallel of distance education - the quality and plausibility of the originality of students' written works vs. the objectivity of teacher assessment.

4 Research Methodology

4.1 Research Problem

Excessive administrative responsibilities at school can lead to teachers' disinterest in innovative networking education. Students can easily use teachers' lack of interest to their advantage when helping themselves with artificial intelligence.

Changes in digitisation and the advent of AI in ChatGPT represent a new challenge for the academic community regarding possible dishonest access by students in the educational environment. This led us to the research problem of recognising texts created by students' AI. On this basis, we set a research goal - to find out the level of recognizability between written works created by students and artificial intelligence by secondary school teachers in Slovakia. We were also interested in whether the teachers had already encountered works prepared by AI instead of the student. While completing the overall picture of the issue, this research tries to answer the following research hypotheses:

1. There is a statistically significant relationship between the success of recognising the text created by the student and created by artificial intelligence and the teacher's age.
2. There is a statistically significant relationship between the success of the recognition of the text created by the student and the creation of artificial intelligence concerning the length of experience of the teacher.
3. There is a statistically significant relationship between the success of the recognition of the text created by the student and the creation of artificial intelligence concerning the teacher's educational level.

Using group random selection, 5 out of 60 state secondary vocational schools in the Trnava and Trenčín Regions in the territory of the Slovak Republic were defined as part of the research set. One list of secondary vocational schools located in the Trenčín and Trnava regions was created from the individual regional lists officially listed in the statistical yearbook of the Secondary School of Education, from which the computer randomly selected five secondary vocational schools. (SOŠ statistical yearbook as of September 15, 2022). The selection did not consider conservatories, special and private secondary schools and gymnasiums. The research

sample consisted of 55 secondary school teachers in the Trenčín and Trnava regions of the Slovak Republic; 75 teachers were approached, assuming that 15 teachers teach in the school. The return rate of the questionnaires was at the level of 73.3 %.

The sample consisted of 20 men, representing 36.4 %, and 35 women, representing 63.6 % of the sample. The largest group in the sample in terms of age were respondents aged 35-44; they made up 50.9 % of the sample. Conversely, the least numerous groups were respondents aged 55-64, who made up only 9.1 % of the sample. In Figure 1, we see the distribution of respondents based on length of practice. Up to 54.5 % of respondents were teachers teaching general education subjects, 40 % taught specialised subjects, and 5.5 % of vocational training masters participated in the research. In Figure 2, we see the sample distribution by type of education.

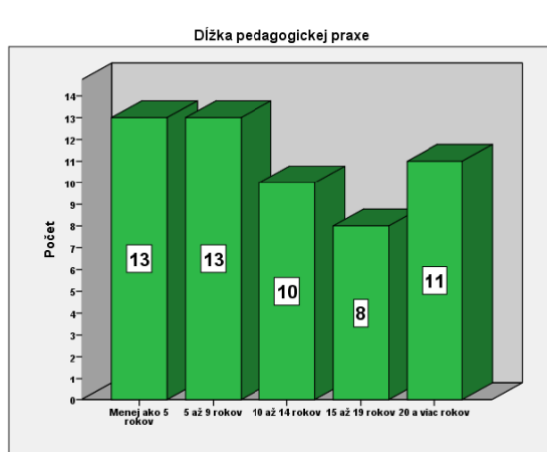


Figure 1: Length of teaching practice

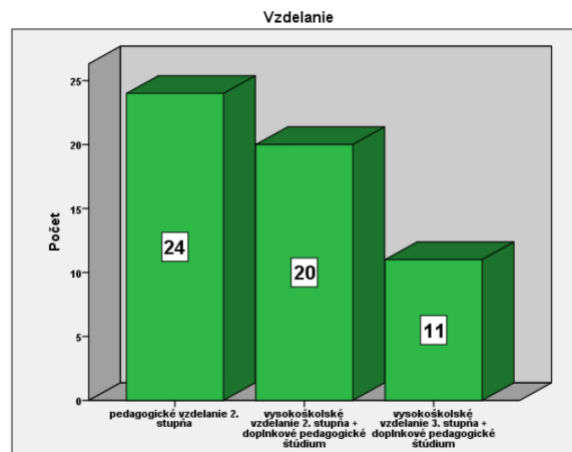


Figure 2: Type of education

4.1.1 Research Design

The primary tool for data collection was an anonymous electronic questionnaire created using the Google tool. With the help of avalanche selection, the researchers contacted the principal or deputy principal of each selected secondary vocational school by e-mail and address with a request to distribute the said e-mail. Data collection took place from September 25th to October 9th, 2023. The questionnaire consisted of an introduction and four parts. The first part was focused on collecting demographic data about the participants. The second and central part of the questionnaire was focused on ten statements from 5 general education subjects, which were always in pairs: 1 authentic answer from a student and one authentic answer that artificial intelligence ChatGPT generated. All ten statements were authentic; the statements were not edited or corrected. Pupils of one secondary school initially prepared their' answers with a registered office in the Bratislava region. One of the authors of this study is a teacher at the mentioned school. Teachers had a choice of 3 options: student work, AI work and student work using AI. In the third part, we were interested in whether teachers

have already encountered the dishonesty of students who used AI in practice. The fourth part left room for teachers to express their opinions.

4.1.2 Data Analysis

Respondents' answers were recorded on Google Excel and Google Docs platforms. To find out the success rate of recognising the text created by the student and created by artificial intelligence, we calculated it as the sum of the correct answers to individual questions 1-10 in the questionnaire. The total score was evaluated on a scale from 0 – the lowest success rate, to 10 – the highest success rate. We used statistical analysis for a comprehensive data evaluation, which we performed in the SPSS 22 program. Due to the established hypotheses and the nature of the data, we used the Spearman correlation test, the Shapiro-Wilk normality test, and the Mann-Whitney U-test for two independent samples in the statistical analysis. We used each of these tests for individual hypotheses by the nature of the specific data appearing in the given hypothesis.

4.1.3 Research Results

55 secondary school teachers were involved in the research. The teachers' direct reactions were that it is tough to distinguish whether it is the student's work or ChatGPT. These reactions are also confirmed by the success rate of recognising text created by the student and created by the AI. The average value of the gross score of the success rate was 5.27 points, which means the success rate of recognising students works at the level of 52.81 %.

Miera úspešnosti rozoznania textu tvoreného žiakom a tvoreného UI
Hrubé skóre

N	55
Priemer	5,2727
Medián	5,0000
Štd. odchýlka	1,92887
Šikmost'	-,307
Špicatosť	,557
Rozpätie	10,00
Minimum	,00
Maximum	10,00

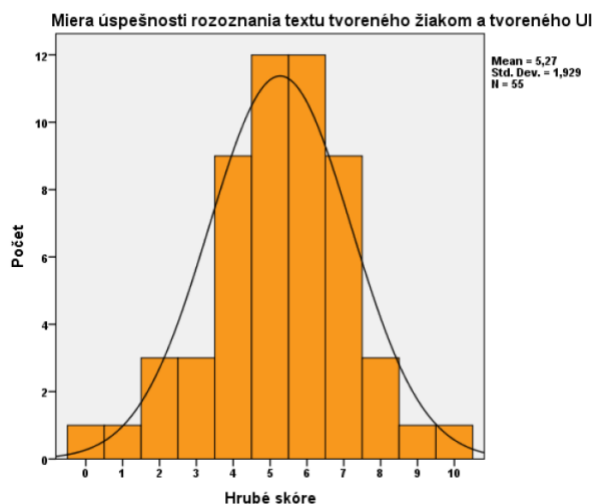


Table 1: Success rate of text recognition

Figure 3: Text recognition success rate

By introducing AI to the public, students were allowed to use it when preparing homework, which is also confirmed by 54.5% of respondents. Novice teachers who completed their pedagogic studies in the 21st century with opportunities to use AI may be able to recognise AI earlier than their colleagues who did not have such direct experience during their studies. From this point of view, we assume a statistically significant relationship between the rate of

success in recognising text created by students and AI and the teacher's age. To test the first hypothesis, we tried to determine if there is a significant relationship between the rate of success in recognising the text created by the student and AI and the teacher's age. To analyse the hypothesis, after considering the variables, we used Spearman's correlation test; where in Table 2: Spearman's correlation test, we see that the correlation coefficient is at the level of 0.054, which means that there is no relationship between age and the success rate of text recognition. This missing relationship is also confirmed in the following indicator, Sig. (2-tailed), where the value is higher than 0.05, which only confirms statistical insignificance. Based on these facts, we conclude that there is no statistically significant relationship between age and the success rate in recognising text created by the student and created by AI. The first hypothesis was not confirmed.

Table 2: Spearman's correlation test

Spearmanov korelačný test		
Miera úspešnosti rozoznania textu tvoreného žiakom a tvoreného UI * Vek		
Spearman's rho	Correlation Coefficient	,054
	Sig. (2-tailed)	,693
	N	55

Literacy, pedagogical experience with the natural expression of students as well as experience with different educational curricula give educators with longer teaching experience a greater chance to recognise work created by AI therefore in the second hypothesis, we verify whether there is a statistically significant relationship between the rate of success in recognising text created by a student and created by AI and length of teaching experience. To analyse the hypothesis, we used the non-parametric Spearman correlation test after considering the variables. Therefore, it is non-parametric because after testing the distribution of the variables, we found that they do not have a distribution according to the Gaussian curve.

In Table 3: Spearman's correlation test, we see that the correlation coefficient is at the level of -0.217, which indicates a weak negative relationship between the length of practice and the success rate of text recognition. Subsequently, we will look at the Sig indicator. (2-tailed), where the value is higher than 0.05, which confirms statistical insignificance. Based on these facts, we conclude that there is no statistically significant relationship between the rate of success in recognising text created by the student and created by AI and the length of practice. The second hypothesis was not confirmed.

Table 3: Spearman's correlation test

Spearmanov korelačný test

Miera úspešnosti rozoznania textu tvoreného žiakom a tvoreného UI * Dĺžka pedagogickej praxe

Spearman's rho	Correlation Coefficient	-,217
	Sig. (2-tailed)	,112
	N	55

In practice, teachers who have completed a technical or economic university and have additionally completed supplementary pedagogical studies, compared to teachers who have completed a regular pedagogical education, are faced with the fact that the level of recognition of text created by a student or AI is markedly different. Therefore, it was interesting for us to build a third hypothesis on the fact that there is a statistically significant relationship in the degree of success in recognising the text created by the student and created by artificial intelligence and the completed university education of the teacher. To complete the overall picture of hypothesis Nr. 3, we see in figure 4 success rate of text recognition created by students and AI for teachers who have a pedagogical education at the level of the value of 6 points.

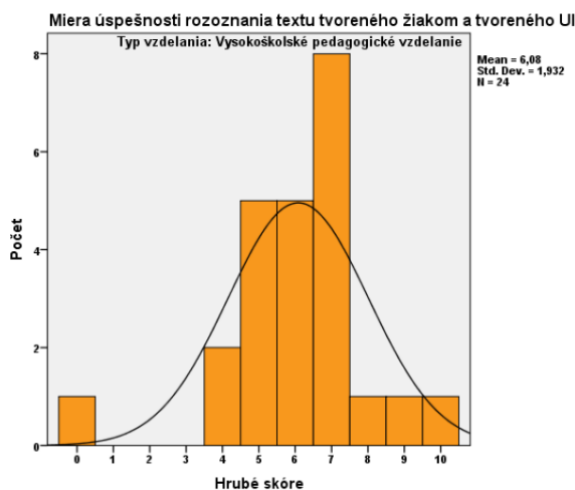


Figure 4: Text recognition success rate University of Pedagogy

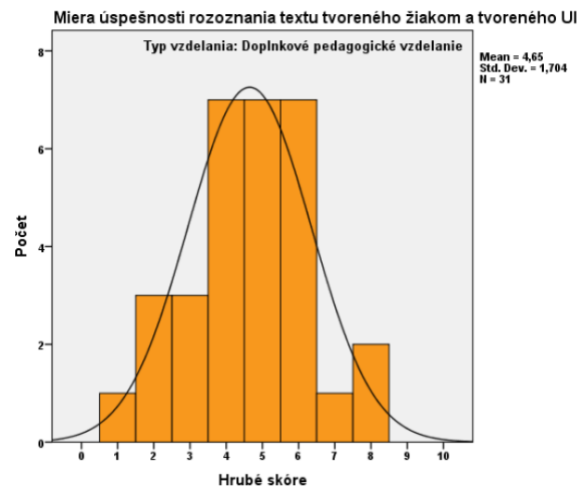


Figure 5: Text recognition success rate University additional pedagogical studies

Figure 5 shows the success rate in recognition of text created by students and AI for teachers who graduated in a different field and supplemented their higher education with additional pedagogical studies at the level of 4.65 points.

To gain knowledge about the normality or abnormality of the data distribution necessary for the subsequent verification of the third hypothesis based on the sample size, we used the Shapiro-Wilk normality test due to the lower number of respondents in the individual samples. In Table 4, based on the data in column Sig. We find that the group of teachers with a university education has a value of 0.017, less than 0.05. For this reason, we must also choose a non-parametric test for testing the hypothesis.

Table 4: Normality test

Miera úspešnosti rozoznania textu tvoreného žiakom a tvoreného UI
Test normality

Typ vzdelania	Shapiro-Wilk		
	Statistic	df	Sig.
Vysokoškolské pedagogické vzdelanie	,895	24	,017
Doplnkové pedagogické vzdelanie	,960	31	,290

When analysing the hypothesis, after considering normality tests and the nature of the distribution of data and variables, we used the non-parametric Mann-Whitney U-test for two independent samples (Table 5). In the test, Asymp. Sig (2-tailed) at the level of 0.002 determined a statistically significant difference between the groups in recognising the text created by the student and created by AI.

Table 5: Mann-Whitney U-test

Mann-Whitney U-test

	Miera úspešnosti rozoznania textu tvoreného žiakom a tvoreného UI
Mann-Whitney U	193,000
Wilcoxon W	689,000
Z	-3,084
Asymp. Sig. (2-tailed)	,002

We will compare this statistically significant difference in text recognition success with the "Mean Rank" values in Table 6: Ranks, where we see that teachers with pedagogical education achieve a statistically higher value at 35.46 compared to teachers with other higher education extended by additional pedagogical studies. The hypothesis has been confirmed.

Table 6: Mean Rank

Miera úspešnosti rozoznania textu tvoreného žiakom a tvoreného UI
RANKY

Typ vzdelania	N	Mean Rank
Vysokoškolské pedagogické vzdelanie	24	35,46
Doplnkové pedagogické vzdelanie	31	22,23
Spolu	55	

5 Discussion

The catalyst for research acceleration was to show teachers the level of AI and how easily students can use it to their advantage. With the help of short texts, the research tried to show that it is complicated to recognise a text written by a student and written by artificial intelligence without knowing the broader context - the written and oral expression of the student, the student's knowledge, abilities and skills in the given subject, the performance standards of the taught subject, the depth of the subjects covered with the students in class, the reading literacy of the teacher - almost unrecognisable. According to the research findings, approximately 52 % of the questioned teachers could correctly recognise text created by a student and texts created by AI. A watchful eye helped some correctly define it, as they noticed small details and differences. When solving the question of how many teachers have encountered a student who brought in completed work that was prepared for him by AI or actively helped him prepare the assignment, the results surprised us. Considering that AI has only been in operation for a year, 54.5 % of teachers have already had experience with dishonest behaviours of pupils and the use of AI. We dare say that introducing artificial intelligence into everyday life has allowed students to find easier ways to complete homework, which can lead to increasing academic dishonesty. This also raises the question of whether our systems are prepared for this kind of academic dishonesty, which is an exciting subject for expanding research activity in the future. When creating hypotheses, we assumed that age and length of practice can be helpful factors in identifying a student's work from the work of AI. At the same time, we assumed that the younger teachers grew up in an era when digital networking and the advent of artificial intelligence were already booming. When determining the second hypothesis, whether the length of practice affects the ability to distinguish between these two texts, we assumed that teachers who have been working in the school system for a longer time will be able to distinguish student works more easily since many years of experience in reading and evaluating works will leave the teacher with skill, he knows the way students express themselves, and therefore it will not be a problem for him to correctly identify the work of students and the work of AI. For both of these hypotheses, our assumptions were not confirmed. Why might this be so? Artificial intelligence, such as ChatGPT, learns on an unimaginably large volume of data, while ChatGPT version 4 is believed to use 100 trillion parameters in its work (Rudolph J. et al., 2023). When evaluating the third hypothesis about the existence of a statistically significant relationship between the level of recognition of texts and the type of teachers' completed education, the results of the research confirmed the hypothesis.

It isn't easy to compare our results with other regional results, as similar research has not yet been published in our territory. In foreign publications, we can find research on the dishonest use of artificial intelligence in academia and various research. However, since this

topic is relatively new, the research itself is still absent. What could teachers do for a better orientation on the issue of artificial intelligence? In addition to attending various engaging trainings, where teachers can also gain positive information about the interesting ways AI can be used in the teaching process, they can take the initiative to familiarise themselves with AI in the form of trial and error.

6 Conclusions

Artificial intelligence has entered everyday life very quickly. Society and its lack of critical thinking, as well as the low level of digital literacy amongst teachers, high bureaucratic burden, insufficient space and lack of interest in following all innovations in the field of information technology, can cause students to seek ways to simplify their school duties increasingly. This applied research aimed to bring to the teachers' attention the maturity of the ChatGPT artificial intelligence tool in general education subjects and the difficulty of recognising its infiltration in student works. In our research sample of 55 teachers, 52.81 % could correctly distinguish student work from ChatGPT AI work. The first and second hypotheses that we set have not been confirmed. The third hypothesis was confirmed. To complete the overall picture of this study, it is necessary to define a certain limitation that could directly or indirectly affect the research results. It should be kept in mind that the data presented in this work represent the individual evaluation of the teachers' statements without a wider knowledge of the students who prepared the text excerpts. We realise that the text excerpts may have been too short for proper assessment. The fact that the students' works were written in the first-person singular and the works written by artificial intelligence were written in the third-person singular could also be of concern to the teachers when evaluating individual excerpts. To draw a general conclusion, whether the possible implementation of changes at the level of work organisation, laws, etc., is a statistically small sample. It is essential to mention that teachers are very busy preparing for classes and administrative matters and receive various requests daily to share information for research. A significant limitation that could make it challenging to evaluate the text is that other artificial intelligence tools can transform the text created by artificial intelligence ChatGPT, BING or others into a text that fully corresponds to the text written by a person.

As part of the research, it would be interesting to expand the issue of the possibilities of AI with the elaboration of an assignment in professional subjects. We propose to expand the research with other demographic data, e.g., age or length of teaching experience.

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Comparison of the Curricula of the Bachelor's Degree in Teaching at Austrian University Colleges of Teacher Education

*Eleonore Lickl*¹

DOI: <https://doi.org/10.53349/resource.2024.is1.a1251>

Abstract

The Bachelor's Degree in Teaching Qualification is a study to obtain a teaching qualification in secondary vocational education. It is a Bachelor of Education (abbrev. BEd) has a length of four semesters. At all four university colleges, where this degree can be acquired, it is organized as part-time study on Fridays and Saturdays. It also includes asynchronous distance learning. The students of these study teach already in parallel at a given vocational high school or college as lecturers, they have a completed university degree of 240 to 300 ECTS credits. The BEd can be acquired at the University Colleges of Teacher Education Upper Austria, of Styria, of Vienna and of Tyrol. These University Colleges are part of alliances, "Verbünde", according to Austrian law, where two or more University Colleges are combined (geographically) to teach the same curriculum. Here the curricula of these BEd studies will be compared. The goals of the studies, the qualifications achieved by completing the studies, and the Study Entry and Orientation phase will be looked at. The differences are in the courses for the STEOP, the Pedagogical-Practical Studies PPS and the length and content of the Bachelor thesis.

Keywords: Curricula, Vocational high school teacher education, Bachelor's degree of Education

1 Introduction

Austria has 14 Universities or University Colleges of Teacher Education; they are organized in four alliances (in German Verbund (sgl.), Verbünde (pl.)) with geographical orientations, north, east, south, middle, and west or combination of those.

- Verbund Nord-Ost includes (original names of the institutions in German) Pädagogische Hochschule Wien, Pädagogische Hochschule Niederösterreich located in

¹ Pädagogische Hochschule Steiermark, Theodor Körner-Straße 38, 8010 Graz.

E-mail: eleonore.lickl@phst.at

Baden, Kirchliche Pädagogische Hochschule Wien/ Krems (College of Teacher Education of Christian Churches), and Hochschule für Agrar- und Umweltpädagogik (University College for Agricultural and Environmental Education), located in Vienna.

- Verbund Süd-Ost includes Pädagogische Hochschule Steiermark located in Graz, Pädagogische Hochschule Kärnten located in Klagenfurt, Private Pädagogische Hochschule Burgenland located in Eisenstadt, and Private Pädagogische Hochschule Augustinum located in Graz.
- Verbund Mitte includes Pädagogische Hochschule Oberösterreich (Linz), Pädagogische Hochschule Salzburg (Salzburg) and Private Pädagogische Hochschule der Diözese Linz.
- Verbund West includes Pädagogische Hochschule Tirol (Innsbruck), Pädagogische Hochschule Vorarlberg and Kirchliche Pädagogische Hochschule – Edith Stein, Innsbruck.

The universities of teacher education offer teacher training courses for the primary level (elementary school), for the secondary level (general education) and for the secondary level (vocational training) and enable career changers to obtain a teaching qualification. In the general education secondary level, they do this in association (or cluster) with the public universities. In other educational areas (e.g. secondary education in Vocational High Schools and Colleges), the universities of teacher education offer bachelor's degrees (and specialized master's degrees).

Four of the University Colleges have special Bachelor studies for lecturers at Vocational High Schools and Colleges. The students of the teaching bachelor's degree acquire additional studies, building on a completed relevant university degree (240 to 300 ECTS credits), the skills and knowledge that enable them to teach specialist theoretical subjects at vocational middle and high schools and colleges (in German, Berufsbildende Mittlere und Höhere Schulen, abbreviated BMHS) or comparable educational institutes. They must have at least three years of working experience in their field.

The nine professional fields are divided into: – Technology, Commerce, and Industry – Construction and Construction-related Industries - Information and Communication Technology – Art, Design and Creation – Applied Chemistry and Biotechnology – Economy and Society as well as Applied Economics and Social Affairs – Health, Exercise, Nutrition and Beauty – Tourism, Gastronomy and Food – Service.

Admission to the bachelor's degree program is given when an employment at a Vocational High School or College has been established. The vocational high school system starts usually in April or May to offer positions (naming the conditions for an application) at all Austrian vocational colleges, by beginning of July most of the positions are usually filled, so in the second half of August the preparatory courses can start (obligatory since 2022). All Austrian

schools and colleges start either the first or the second week of September, the Bachelor studies start with the academic year 1st of October.

2 Bachelor Curricula in Comparison

The study with these curricula started in the academic year 2016/2017. Here a comparative look is done at the actual version of the curriculum with is used in the Winter semester of 2023/2024. The names of the curricula are given in German, they have the links included, so you can get your own translation. All Curricula are in German.

Verbund Süd-Ost: Curriculum für das Bachelorstudium im Bereich der Sekundarstufe Berufsbildung - Facheinschlägige Studien ergänzende Studien zur Erlangung eines Lehramtes in der Sekundarstufe Berufsbildung im Entwicklungsverbund Süd-Ost, published on 09-05-2022

https://www.phst.at/fileadmin/Mitteilungsblaetter/Studienjahr_2021_2022/MB_26_Curriculum_FachErg_SekBB_Bachelor.pdf

Verbund West: Curriculum Facheinschlägige Studien ergänzendes Bachelorstudium zur Erlangung eines Lehramtes im Bereich der Sekundarstufe Berufsbildung, published on 29-06-2018 <https://www.ph-online.ac.at/pht/wbMitteilungsblaetter.display?pNr=650618>

Verbund Nord-Ost: Curriculum Bachelorstudium – Sekundarstufe Berufsbildung für das Lehramt Facheinschlägige Studien ergänzende Studien, published 05-12-2022 https://phwien.ac.at/wp-content/uploads/2022/12/BAC_FESE.pdf

Verbund Mitte: Curriculum Bachelorstudium Sekundarstufe Berufsbildung Facheinschlägige Studien ergänzende Studien, published 19-01-2022 https://ph-ooe.at/fileadmin/old_fileadmin/fileadmin/user_upload/ausbildungbs/Curricula_Neu_ab_2022/2022.01.19_BAC-FSES.pdf

The Bachelor curriculum is a modular one and lasts four semesters, part time, on Fridays and Saturdays. It must include Educational Sciences (in German Bildungswissenschaften) and Subject Didactics (Fachdidaktik). In total, 60 ECTS credits have to be studied by any student. In the curriculum Specialist Sciences (Fachwissenschaften) will be credited with 180 ECTS credits (these had been necessary to get a teaching position, anyway. Completed relevant university degree have to include 240 to 300 ECTS credits as stated above.) A Bachelor thesis is compulsory for the completion of the study, the credits given vary between the different universities. The Curriculum has the amount of 240 ECTS credits at all University Colleges (these are Educational Sciences plus Subject Didactics plus creditable Specialist Sciences plus Bachelor thesis, if named separately).

2.1 Goals

The bachelor's degree to obtain a teaching qualification in secondary vocational education aims at professional and science-oriented training in the skills necessary to practice the profession. In 2005 the Hochschulgesetz (HG) and its guiding principles (§ 8 HG 2005, § 9 HG 2005) are basis for the curricula. The aim is to provide graduates with basic general and specific pedagogical skills, technical and didactic skills, inclusive and intercultural skills, social skills and counseling skills. Personal and systemic competencies as well as the competencies for implementing the school partnership must be promoted.

2.2 Qualification Achieved by the BEd Degree

The successful completion of the bachelor's degree is a teaching qualification (HCV, § 2 Zi 2 HCV 2013) at a Secondary Vocational College. The curriculum of Verbund West specifies engineering pedagogy, especially.

“Vocational education as a science and practice of vocational education focuses on the quality of content of the concept of profession and begins with professional competence. Learning and teaching in the Vocational training establishes the connection between careers – in the sense of comprehensive professionalism open design elements – and learning at the center.” (Verbund West, 2.1., p.7 in German)

2.3 Comparison of Content and Courses

Verbund Süd-Ost: 20 ECTS credits are asked in Basis in Educational Sciences (in German Bildungswissenschaftliche Grundlagen), 30 ECTS credits in Subject Didactics (Fachdidaktik), Pedagogical-Practical Studies (Pädagogisch-Praktische Studien, abbreviated PPS) are included and consists of 16 ECTS credits). The Bachelor thesis is 10 ECTS credits, these ECTS credits are not included, they can be done at any course which had been taught during the semesters, only these lecturers can agree to look after the Bachelor thesis. Therefore, 60 ECTS credits are reached to fulfill the requirements.

Verbund West asks 23 ECTS credits in Educational Science (Bildungswissenschaft), 22 ECTS credits in Subject Didactics (Fachdidaktik), Pedagogical-Practical Studies have 15 ECTS credits. In this curriculum the Bachelor thesis with five ECTS credits is already included.

Verbund Nord-Ost: Here Educational Sciences are 30 ECTS credits, Subject Didactics are 30 ECTS credits, 15 ECTS credits for PPS are included, as well as 10 ECTS credits for the Bachelor thesis.

Verbund Mitte: 24 ECTS credits for Basis in Educational Sciences, Subject Didactics 30 ECTS credits + six ECTS credits from a compulsory chosen module, 12 ECTS credits for PPS and six ECTS credits for the Bachelor thesis are included.

The curricula vary in the number of lectures versus seminars. At Verbund Süd-Ost there are three lectures, at Verbund West are seven lectures, Verbund Nord-Ost has no lectures. Verbund Mitte offers two lectures. All the other courses are seminars or exercises, which results in much more student involvement than lectures. There are also mixt courses: lecture with exercise and exercise with lecture, UV, see later.

Table 1: Example of Course Titles for Basics of Educational Sciences in different Curricula

<i>English title</i>	<i>German title</i>
<i>Basics of the teaching profession</i>	<i>Grundlagen des Lehrberufs</i>
<i>Learning and development in adolescence</i>	<i>Lernen und Entwicklung im Jugendalter</i>
<i>Educational Psychology for Schools and Teaching</i>	<i>Pädagogische Psychologie für Schule und Unterricht</i>
<i>Reflect on the teacher's role</i>	<i>Lehrer*innen-Rolle reflektieren</i>
<i>Basics of Vocational Education</i>	<i>Grundlagen der Berufspädagogik</i>
<i>Framework conditions for vocational training</i>	<i>Rahmenbedingungen beruflicher Bildung</i>
<i>Basics of school law</i>	<i>Schulrechtliche Grundlagen</i>
<i>Specific Aspects of Vocational Education</i>	<i>Spezifische Aspekte von Berufspädagogik</i>
<i>Didactics and methodology of vocational learning</i>	<i>Didaktik und Methodik berufsbildenden Lernens</i>
<i>Lesson planning in the context of the special situation of vocational schools</i>	<i>Unterrichtsplanung im Kontext der speziellen Situation berufsbildender Schulen</i>
<i>Evaluation and Quality management in vocational training and their implementation in the professional field</i>	<i>Evaluation und QMS in der Berufsbildung und deren Umsetzung im Berufsfeld</i>
<i>Dealing with heterogeneity at vocational schools</i>	<i>Umgang mit Heterogenität an berufsbildenden Schulen</i>
<i>Teaching and learning</i>	<i>Lehren und Lernen</i>
<i>Youth culture and social habitat school</i>	<i>Jugendkultur und sozialer Lebensraum Schule</i>
<i>Legal foundations in school law</i>	<i>Gesetzliche Grundlagen im Schulrecht</i>
<i>Assessment of performance in vocational training</i>	<i>Leistungsfeststellung in der Berufsbildung</i>

<i>Group processes and conflict management</i>	<i>Gruppenprozesse und Konfliktmanagement</i>
<i>Professionalization of teachers in vocational training</i>	<i>Professionalisierung von Lehrenden in der beruflichen Bildung</i>
<i>Science and vocational training research</i>	<i>Wissenschaft und Berufsbildungsforschung</i>
<i>Education in a social context</i>	<i>Bildung im gesellschaftlichen Kontext</i>
<i>Teaching and motivation</i>	<i>Lehren, Lehren und Motivation</i>
<i>Teaching as a profession</i>	<i>Lehrberuf als Profession</i>
<i>Special aspects in educational sciences</i>	<i>Spezielle Aspekte in den Bildungswissenschaften</i>

2.4 Study Entrance and Orientation Phase STEOP

Since 2005 a law is given, that the first semester of any study has to include a study entrance and orientation phase (STEOP) (BGBl. I Nr. 74/2006, BGBl. I Nr. 81/2009). The content of the courses serves to provide orientation in the studies. Although the bachelor's degree study is only open to personnel of vocational high schools, this STEOP is obligatory. Eight ECTS credits have to be gained in the first semester at every of the universities of teacher education. As the curricula vary, also the courses vary.

2.5 STEOP Courses

The various STEOP courses are listed here (Table 2 to Table 5), the English translation is given on the left, the original German version is on the right side.

Introduction to Teaching and Learning VO 3 ECTS	Einführung in Lehren und Lernen VO 3 ECTS
Orientation in the professional field UE 1 ECTS	Orientierung im Berufsfeld UE 1 ECTS
Introductory didactic aspects SE 2 ECTS	Einführende fachdidaktische Aspekte SE 2 ECTS
Professional Curriculum Interpretation SE 2 ECTS	Professionelle Lehrplaninterpretation SE 2 ECTS

Table 2: Verbund Süd-Ost – STEOP Courses

School as an educational institution and the role of the teacher SE 1 ECTS	Schule als Bildungsinstitution und Rolle der Lehrperson SE 1 ECTS
School as an educational institution and the role of the teacher UE 3 ECTS	Schule als Bildungsinstitution und Rolle der Lehrperson UE 3 ECTS

Conditions of professional learning/teaching processes VO 1 ECTS	Bedingungen beruflicher Lern-/Lehrprozesse VO 1 ECTS
Didactics of professional learning/teaching processes SE 3 ECTS	Didaktik beruflicher Lern-/Lehrprozesse SE 3 ECTS

Table 3: Verbund West – STEOP Courses

Legal foundations in school law SE 2 ECTS	Gesetzliche Grundlagen im Schulrecht SE 2 ECTS
Performance assessment in vocational training SE 2 ECTS	Leistungsfeststellung in der Berufsbildung SE 2 ECTS
Professional curriculum interpretation and implementation SE 2 ECTS FD	Professionelle Lehrplaninterpretation und Umsetzung SE 2 ECTS
Conduct and evaluate lessons SE 2 ECTS	Unterricht durchführen und evaluieren SE 2 ECTS

Table 4: Verbund Nord-Ost – STEOP Courses

Learning and development in adolescence (incl. 1 ECTS-AP STEOP) UV	Lernen und Entwicklung im Jugendalter (inkl. 1 ECTS-AP STEOP) UV
Introduction to teaching SE 1 ECTS	Einführung in die Unterrichtstätigkeit SE 1 ECTS
Educational Psychology for Schools and Teaching SE 2 ECTS	Pädagogische Psychologie für Schule und Unterricht SE 2 ECTS
Conditions of teaching and learning processes in vocational training SE 1 ECTS	Bedingungen von Lehr- und Lernprozessen in der Berufsbildung SE 1 ECTS
Didactics of teaching and learning processes in vocational training SE 3 ECTS	Didaktik von Lehr- und Lernprozessen in der Berufsbildung SE 3 ECTS

Table 5: Verbund Mitte – STEOP Courses

2.6 Pedagogical-practical Studies PPS

Verbund Süd-Ost: “The pedagogical concept is as follows: The central objectives are to develop an investigative attitude, a scientific-reflexive habitus, and a habitus of routinized practical skills. In keeping with the intention of evoking personalized development processes in the best possible way, personalized learning, practical research as well as research and practical coaching interact in a concerted manner. As learning arrangers, practical coaches encourage prospective teachers to engage in reflection processes as well as development and implementation as part of the pedagogical-practical studies through structured orientation discussions tailored to the individual needs of the students, the construction of adequate tasks

or learning environments and individually tailored coaching efforts and evaluation of independent solutions". (Verbund Süd-Ost, p.14, in German).

The concept uses an accompanied practice transfer. The 16 ECTS credits are divided in four belonging to Educational Sciences and 12 ECTS credits belonging to Subject Didactics.

Verbund West has in total 15 ECTS credits. Verbund Nord-Ost divides the ECTS credits in five to Educational Science and 10 to Subject Didactics. Verbund Mitte divides in three ECTS credits from Basis in Educational Sciences and 12 to Subject Didactics. This curriculum specifies also action research (in German Aktionsforschung). It also specifies pedagogical-practical studies in detail: it should include:

- Professional self-image as an educator with special consideration of the Vocational pedagogy and the EPIK model (Schratz et al, 2008)
- Lesson planning and implementation
- Performance assessment and assessment
- Heterogeneity in learning requirements: individual vocational training; Talent and Promoting talented people in vocational training
- Reflection and evaluation of teaching activities
- School organization and processes
- Team building and cooperation
- Quality Management instruments for school and teaching development (Verbund West, p. 29, in German)

The curriculum also lists the competencies, that should be gained by the Pedagogical-Practical Studies.

The graduates can.

- plan, implement, reflect on, and evaluate fundamental elements of school teaching and learning in vocational training based on specialist sciences, specialist didactics and educational sciences according to the EPIK model (Schratz et al, 2008),
- develop an educational-professional self-image and continuously work on your own professionalization through personal priorities,
- create, apply, argue, reflect, and evaluate concepts, procedures and feedback for performance assessment and assessment,
- prepare and carry out your lessons in a methodical, goal- and professional-field-oriented manner,
- conduct consultations in a school environment with students, apprentice trainers, cooperation partners and interdisciplinary groups or organizations in an appreciative, context-, addressee- and task-specific manner,
- implement the special features of individual training in the vocational school system in everyday teaching in a target group-appropriate manner,
- apply, analyze, and evaluate the QMS instruments for school and teaching development and develop future action strategies,

- recognize talents and apply options for promoting talent and talent,
- recognize the heterogeneity of the teaching group as a resource and potential and design the lessons in a way that is appropriate for diversity,
- promote the acquisition of social-communicative skills as well as the ability of students to work in teams and deal with conflict through social learning and cooperative forms of work,
- develop an investigative attitude in teaching and use school learning areas as starting points for investigative learning and academic-scientific cooperation benefits,
- understand and justify the relevance of the theory-practice relationship for vocational education research and fields of action,
- derive cultural, ethnic, religious, age, gender, language, talent, and disability-related diversity based on models and theories of inclusive pedagogy and their significance for professional pedagogical action. (Verbund West, p. 30, in German)

3 Conclusion

Although a small country by its size, Austria is divided into nine provinces, furthermore private partners are interested in teaching and pedagogy. Therefore, 14 universities colleges of teacher education exist. They are organized in four alliances, in all four of them teachers for the secondary vocational level for vocational schools and colleges, Berufsbildende Mittlere und Höhere Schulen, BMHS, can acquire the Bachelor of Education degree, BEd, which is necessary to teach the specific fields. To get a position a completed relevant university degree of 240 to 300 ECTS credits must be given.

The four curricula have the same modular framework, 240 ECTS credits, four semesters, part time, but in detail there are differences in the number of Educational Sciences and Subject Didactics, different courses taught, different courses for the study entrance and orientation phase and different ideas about the Pedagogical-Practical Studies. Also, the scope of ECTS credits for the Bachelor thesis vary from five, to six and to 10 ECTS credits.

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Intergenerational Exchange: Connecting Learning Experiences Across Generations

Michal Matějka¹, Roman Kořán²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1252>

Abstract

Intergenerational exchange, defined as interaction and communication between different generations, offers the potential for synergy between life experiences and learning. This concept represents an essential dimension of social capital and social learning that goes beyond traditional forms of education. Within this multidimensional phenomenon, intergenerational mentoring is required, where older generations pass on their accumulated experiences to younger generations, thereby facilitating the development of critical thinking and complex social understanding. For the effective implementation of intergenerational exchange, adaptability and flexibility of educational programmes and strategies is a key factor to ensure that the needs of different generations are addressed comprehensively. In this context, it is important to clarify that intergenerational exchange is not just a one-way process but rather an interactive dialogue that can involve different forms of learning, including formal, non-formal and incremental learning. It also includes aspects of social capital and promotes community involvement. This pilot study focuses on theoretical and practical research that explores the impact on social cohesion and mentions potential challenges associated with this process. It also analyses the factors that influence the successful implementation of intergenerational learning and identifies strategies for promoting intergenerational dialogue and learning.

Keywords: Intergenerational exchange, Intergenerational mentoring, Social capital, Social learning, Education, Comprehensive social understanding, Incremental learning, Community engagement, Social cohesion, Gender and intergenerational exchange.

¹ Pan-European University, Faculty of the College of Business. Department of Economics and Human Resources, Spálená 76/14, Nové Město, 110 00 Prague 1, Czech Republic,
E-mail: michal.matejka@is.peuni.cz

² Pan-European University, Faculty of the College of Business. Department of Economics and Human Resources, Spálená 76/14, Nové Město, 110 00 Prague 1, Czech Republic,
E-mail: roman.koran@peuni.cz

1 Introduction

Intergenerational exchange is gaining increasing recognition as an essential pedagogical approach that focuses on connecting individuals of different generations and promotes sharing educational experiences and knowledge. This practice recognises the value of intergenerational learning and seeks to bridge the gaps between other age groups, facilitating the transfer of wisdom, skills and perspectives. Intergenerational exchange enriches the learning experiences of older and younger participants but also strengthens social bonds and fosters a sense of belonging and understanding between generations. The concept of intergenerational learning exchange is based on the belief that individuals of different age groups can learn from each other and contribute to the development of others. For younger learners, connecting with the older generation provides unique opportunities to gain insights into historical events, cultural traditions and life experiences that textbooks alone cannot provide. Conversely, older adults benefit from active participation in intergenerational exchanges by remaining engaged and continuing to contribute their knowledge and skills to the community. Intergenerational exchange is even more critical in today's rapidly changing world, characterised by technological advances and evolving social dynamics. By connecting different generations, this practice enables the transmission of traditional knowledge and values while supporting the development of digital literacy and other 21st-century skills. In addition, intergenerational exchange helps to overcome stereotypes and prejudices between age groups and promotes empathy and understanding in the educational process for both groups.

This thesis aims to explore the concept of intergenerational exchange as a means of connecting learning experiences across generations. It will explore the benefits and challenges associated with this practice and identify potential strategies for successful implementation into practice. It will also focus on the role of technology and the importance of creating inclusive environments that foster meaningful connections between individuals of different age groups. In conclusion, intergenerational exchange as a pedagogical approach holds tremendous potential for developing comprehensive and inclusive learning environments for all given age groups.

By actively promoting the sharing of experiences, knowledge and skills between generations, educational institutions can harness the power of intergenerational collaboration to improve the overall educational process and strengthen community social ties.

2 Intergenerational Exchange

Intergenerational exchange, defined as interaction and communication between different generations, carries the potential for synergy between life experiences and learning. This

concept represents an essential dimension of social capital and learning that transcends traditional forms of education (Najjar & Singh, 2016).

It involves intergenerational mentoring, whereby the older generation passes on their accumulated experiences to the younger generation, facilitating the development of critical thinking and comprehensive social understanding (Hui, Chan & Tse, 2018).

For the effective implementation of intergenerational exchange, adaptability and flexibility of educational programs and strategies are key factors that allow for comprehensive consideration of the different needs of each generation. Intergenerational exchange should be seen as an interactive dialogue and not just a one-way process that involves various forms of learning, such as formal, informal, and incremental learning. It also includes aspects of social capital that contribute to community involvement and strengthening social cohesion.

A comprehensive study that focuses on theoretical and practical research is necessary to understand the impact of intergenerational exchange on social cohesion and to identify potential challenges associated with this process. It is required to analyse the factors influencing the successful implementation of intergenerational learning and identify strategies to promote intergenerational dialogue and learning (Hui, Chan & Tse, 2018).

2.1 Intergenerational Mentoring and Supervision

Intergenerational mentoring is a key element of intergenerational exchange, in which the older generation passes on its accumulated experience and learning to the younger generation. This process promotes the development of critical thinking and comprehensive social understanding. Intergenerational exchange is an important element of social capital and social learning that transcends traditional forms of education (Najjar & Singh, 2016).

Intergenerational supervision in education is a concept that brings together different age groups (generations) to provide education and support. This approach involves bringing together different age groups, such as children, youth, and older generations, to share knowledge, experiences, and skills (Hui, Chan & Tse, 2018).

In practice, intergenerational supervision in education can take different forms:

- 1) **Mentoring and tutoring:** Older individuals can mentor and guide younger people in areas where they have experience and knowledge. This can occur in school settings, non-formal education, or community programmes.
- 2) **Mutual exchange of skills and knowledge:** Children, young people and older generations can work together on projects or activities where each group brings unique perspectives and skills.
- 3) **Volunteering and volunteering:** People of different age groups can work together as volunteers in schools, communities, or for a particular social initiative.

- 4) Community programs and events:** Organizing events that bring people of different ages together through workshops, cultural events, clubs, etc (Najjar & Singh, 2016).

Intergenerational supervision in education brings many benefits. It helps create stronger communities where people learn from each other and build intergenerational relationships. This approach can help improve understanding and respect between generations and reduce social isolation and loneliness among older people. It also promotes the development of skills in younger individuals and strengthens their self-esteem.

During the implementation of intergenerational supervision in education, it is important to provide an appropriate environment for these interactions, respecting the individual needs of each age group and encouraging an open exchange of views and experiences (Suchá, 2021).

2.2 Social capital in intergenerational exchange

Social capital is vital in intergenerational exchange because it provides the basis for relationships, trust and cooperation between different generations. Social capital is defined as a set of norms, values and social ties that facilitate cooperation and social interaction. In an intergenerational context, social capital is a resource that promotes the transfer of experience and learning between generations. Intergenerational exchange also contributes to strengthening social capital through networking and community development.

Younger generations can benefit from older generations' expertise and practical experience, thereby expanding their social and economic opportunities. Implementing intergenerational exchange regarding social capital requires active support and participation from individuals and institutions. It is essential to facilitate building and maintaining social ties to enable knowledge transfer and the potential for intergenerational learning. Detailed scientific research and studies are necessary to understand and value social capital in intergenerational exchange and to identify the most effective ways to promote its development and use in intergenerational interactions (Hui, Chan & Tse, 2018).

2.3 Social learning in the young generation

Social learning is the process by which individuals acquire knowledge, skills and practices through interaction with other members of society. It is based on the premise that social interaction and observation of other people play a crucial role in shaping individual behaviour and learning. In intergenerational exchange, social learning becomes even more important as different generations can share their experiences, knowledge and perspectives (Hui, Chan & Tse, 2018).

In this way, younger generations can learn from older generations how to solve problems, adapt to change, and develop on a personal and professional level. Social learning is promoted through various forms of interaction, including direct mentoring, modelling, collective learning, and sharing resources and information. This process enables a dynamic exchange of knowledge and the anchoring of that knowledge in a social context. To achieve successful social learning in intergenerational exchange, it is important to create a supportive environment that encourages respect, open communication, and cooperation between generations. It is also necessary to consider each generation's individual needs and preferences and create space for mutual learning and sharing of experiences.

Research studies, articles, and theoretical approaches are available for a scientific perspective and a deeper understanding of social learning in intergenerational exchange. These resources provide a framework for analysing social learning processes and the benefits of intergenerational exchange in the context of society (Brücknerová, Kamanová, Novotný, Pevná, & Rabušicová, 2016).

Examples of social learning in the young generation:

- 1) **Digital and social media:** Young people are exposed to social learning through various social media platforms. These media influence their behaviour, opinions, and attitudes through information sharing and interaction with human consciousness and the content of the information shared.
- 2) **Cultural Diversity and Globalization:** Young people are exposed to diverse cultures and views due to globalisation and the diversity of society. This enables their understanding of the world and opens up new perspectives.
- 3) **Behavioural patterns and values:** The young generation learns from observing and interacting with different behavioural patterns and values in the family, school, community and through the media. This can shape their values and beliefs (Suchá, 2021).
- 4) **Education and schooling:** Schools play a vital role in socialisation and formal education.
- 5) **Family and community environment:** Young people learn much from their family and community environment. Values, traditions, and attitudes are integral to socialisation and thus implement value influences into some aspects of community behaviour and their diverse worldviews (Matějka et al., 2023).

The impact of social learning on the younger generation can be enormous. The rapid development of technology and communications can cause reduced levels of reality and

logical reasoning. Young people can absorb various information and values, positively and negatively impacting their behaviour, feelings, attitudes, and decision-making.

Therefore, it is essential to promote critical thinking and spread media literacy among the young generation so that they can analyse information, distinguish between different perspectives, and form their own considered opinions and values (Kořán et al., 2023)

3 Education in a Global Context

Education across generations plays a key role in the global context, not only as a means to transfer knowledge and skills but also as a means to develop and strengthen societies across generations (UNESCO, 2015). Education can influence socio-economic growth, improve social mobility, and enhance human capital in society. In an intergenerational context, education is an important aspect of transferring knowledge and skills from generation to generation. Older generations can pass on their wealth of experience and wisdom to younger generations, which contributes to developing their cognitive and social skills. At the same time, younger generations can participate in innovation and share their new knowledge and perspectives, contributing to social development (Hui et al., 2018).

An intergenerational approach in education requires cooperation between different generations and respect and use of different experiences and perspectives. It is crucial to create an environment conducive to intergenerational learning and dialogue that allows for mutual inspiration and cooperation. Many research studies, articles and theoretical approaches exist for the global context of education across generations. These resources provide insights into the benefits and challenges associated with implementing intergenerational learning and offer strategies for effectively integrating different generations into education (Chen & Pu, 2012).

3.1 Social Understanding Complex

The social understanding complex represents a deep and complex level of understanding between members of a society that involves not only positive perception and respect but also an understanding of cultural, social and emotional aspects. It is the ability to perceive and understand diversity in society and accept individuals with unique values, beliefs, and experiences. Active engagement in interactions and dialogues with diverse groups and individuals, with an open mind, is essential to achieve a comprehensive social understanding and a willingness to focus on differences and similarities in perceptions and representations of reality. Such an approach allows for a deeper understanding of the context in which an individual finds himself or herself and for broadening perspectives on social and cultural diversity. Education and awareness-raising play a key role in promoting a comprehensive social understanding within society. Inclusive education and multicultural programmes have

the potential to broaden awareness of different cultures, values and attitudes, thereby building respect and tolerance for different perspectives. The scholarly perspective on the field of comprehensive social understanding includes extensive research and theoretical approaches.

These studies provide important information and insights into the processes that facilitate or hinder the development of complex social understanding and offer ways in which education and outreach can support this field (Bertucci, 2017).

3.2 Incremental Learning

Incremental learning, also known as "gradual learning or adaptive learning", is the process of acquiring and developing knowledge, skills and abilities through incremental improvement. In incremental learning, individuals focus on personal development, acquiring new skills and improving their abilities through patience, dedication and improvement in response to feedback and experience. Incremental learning is linked with a growth mindset in everyone's personal life, emphasising the belief that intelligence and skills can be developed through effort and endeavour. This approach promotes resilience to failure and increases motivation to learn and improve, leading to improved performance and achievement in the long term. In incremental learning, the individual's active participation in his or her own learning process, reflection and correction of mistakes, and the ability to learn from and adapt to new situations are essential.

Research on incremental learning and growth mindset provides important insights into how this approach affects an individual's learning performance, motivation, and personal growth (Carver & Scheier, 2014).

3.3 Community Engagement in Education Based on Intergenerational Exchange

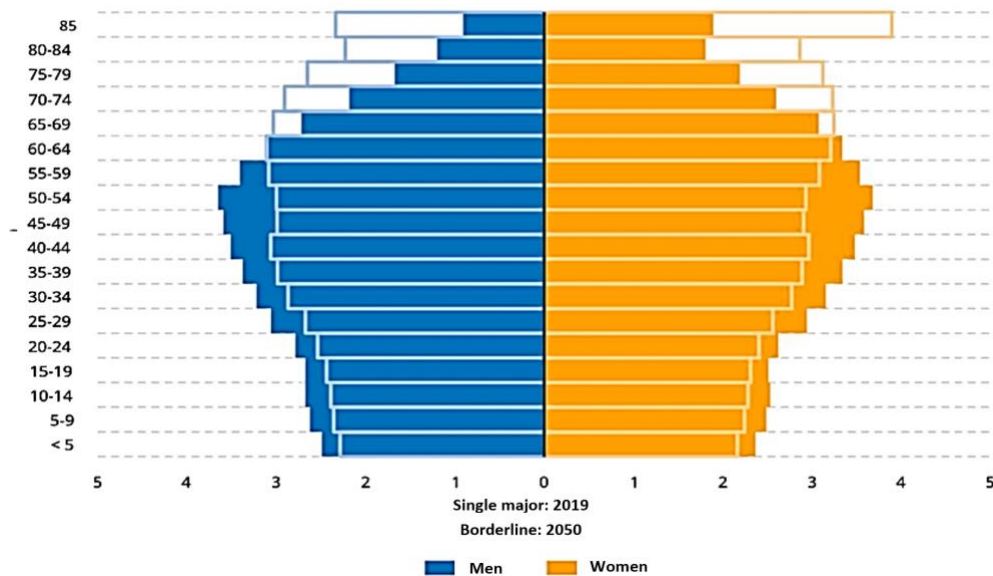
Community engagement in intergenerational learning involves different generations' active involvement in joint projects and activities that benefit the community (Harwood et al., 2015). This approach aims to strengthen social cohesion and community development and promote sustainable social development. There are many benefits to community engagement in education through intergenerational exchange. Research shows that community engagement in education enhances the performance, motivation, and sense of belonging of individuals and teams, as well as influences positive community-wide change. Increased communication, collaboration and mutual support across generations lead to trusting relationships and strengthen social capital in the community. To promote community engagement in intergenerational learning, it is vital to consider the individual needs and preferences of each generation, as well as create an environment that fosters inclusive and respectful dialogue between generations (Burke & Bertucci, 2017).

The involvement of community organisations, schools, and parents is also crucial for the successful implementation of community engagement in education (Brücknerová et al., 2016). The older generation passes on their knowledge and skills to the younger generation, which contributes to the development of their competencies and the educational development of the younger generation" (Harwood et al., 2015).

"It also increases the younger generation's awareness of the experiences, traditions, and values of the older generation, which promotes the cultivation of education, respect, and mutual understanding between generations" (Burke, K., & Bertucci 2017).

4 Social cohesion in intergenerational exchange in the male and female population

Social cohesion is the force that binds individuals in a community together and creates mutual trust, belonging and cooperation. In the context of intergenerational exchange, social cohesion significantly impacts the development and maintenance of relationships and the promotion of social capital. This process creates opportunities for cooperation, sharing experiences and mutual understanding, which strengthens the bonds of solidarity and belonging between generations. Social cohesion in intergenerational exchange is linked to various factors. For example, common goals and values, mutual understanding, respect, and a belief in the benefits of cooperation and exchange between generations. It is also important to have an environment that encourages open communication and interaction between generations. Gender can play an important role in this process as there are certain expectations, roles and norms associated with each gender in different societies. Yet, it is important to consider that these roles may be different in different cultures and may be influenced by social, economic, and political factors (Hui et al., 2018; Lavoie & Deaudelin, 2012).



Population pyramid, EU-27, 2019 and 2050% share of the total population
(Source: Kořán et al., 2023, s. 94)

4.1 Educational Challenges in the Intergenerational Consensus

Education in the global context faces many challenges that affect its effectiveness and the achievement of equity. Here are some examples of these challenges, supported by expert sources:

- 1) **Technology generation gap:** Different generations have different relationships with technology. While younger generations are more technologically savvy, older generations may struggle with modern technology. Educational institutions should find ways to bridge these differences and enable all generations to use technology effectively for education.
- 2) **Differences in learning preferences:** Different generations may have different learning preferences and education. Older generations may prefer traditional learning methods, while younger generations focus on interactive and digital forms of learning. This diversity requires flexibility and adaptation in educational programmes (Brücknerová et al., 2016).
- 3) **Changes in the labour market and the skills gap:** New skills are needed with the rapid pace of change in technology and the labour market. Older generations may need retraining or support in acquiring new skills, while younger generations may feel dissatisfied with traditional training programs that may not meet current labour market needs (Bertucci, 2017).

- 4) **Different experiences and perspectives of generations:** Each generation has unique experiences that influence their worldview and education. Older generations may have richer work experiences that they want to share, while younger generations may have new perspectives and skills that could be useful to older generations. The challenge is to find ways to harness this diversity for mutual benefit.
- 5) **Barriers to communication between generations:** There can be a lack of communication between generations, hindering the effective sharing of experiences and knowledge. Sometimes, there can be conflicts between generations, making it difficult to reach a consensus (Kořán et al., 2023).
- 6) **Recognition of the value of experience:** The value of the experience of all generations must be recognised and respected. This may include formalising knowledge-sharing programs across generations and including older people as mentors in educational programs (Suchá, 2021).
- 7) **Promoting lifelong learning:** Given the rapid changes in technology and the labour market, promoting lifelong learning for people of all ages is increasingly important. This includes retraining and continuing education opportunities for the older generation (Beneš, 2014).

5 Conclusion

In 2023, intergenerational exchange of experience is a hugely important aspect of the educational paradigm, with the potential to revolutionise the approach to knowledge transfer between generations. Current studies in social psychology and education reveal that the development of cognitive skills, critical thinking and problem-solving strongly influences intergenerational interactions. It has been shown that the traditional hierarchy that in the past only allowed for the unidirectional transfer of knowledge from teacher to student is increasingly shifting towards a multidirectional approach. Including experiences from different age groups brings diversity to the educational process, which encourages creativity and innovation. New technologies, such as virtual reality and online platforms, enable generations to connect across geographic barriers, improving the reach and accessibility of intergenerational knowledge exchange (LoBuono et al., 2019).

This phenomenon fosters social integration and facilitates the creation of bridges between older and younger generations. This scholarly approach brings the perspective that intergenerational connections are the basis for a broader understanding of the history, present and preparing for the future. Education across generations thus becomes essential to achieve the co-development of society within a dynamic environment for the 21st century.

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Transforming Higher Education: Psychological and Sociological Perspective (the use of artificial intelligence)

Jana Matochová¹, Petra Kowaliková²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1253>

Abstract

The present paper aims to analyse the growing importance of artificial intelligence (AI) in higher education and its impact on students from a psychological and sociological perspective. With the growth of technological tools and data analytics in education, AI offers new opportunities for personalising instruction and improving student outcomes. From a psychological perspective, relevant topics include how AI affects students' motivation, self-control, and learning strategies. The sociological perspective focuses on the transformation of social interactions between students and educators and on the limits of accessibility to higher education through digitalisation. The ethical and social challenges associated with using AI in education and its potential impact on access to higher education inequalities are also discussed. The article seeks to contribute to a deeper understanding of the transformation of higher education and highlight the need for a multidisciplinary approach to this complex topic.

Keywords: Artificial intelligence, Motivation, Learning Strategies, Mental hygiene, Ethical and Social challenges

1 Artificial Intelligence in Education: Opportunities and Challenges

The expansion of the Internet at the turn of the millennium enabled and accelerated the development of online education, e-learning, educational platforms, and learning content management systems based on the capabilities of artificial intelligence. The further

¹ VSB-Technical University of Ostrava, 17. listopadu 15/2172, 708 33 Ostrava – Poruba, Czech Republic.

E-mail: jana.matochova@vsb.cz

² University of Ostrava, Faculty of Philosophy, Mlýnská 5, 701 03 Ostrava 1, Czech Republic.

E-mail: petra.kowalikova@osu.cz

development of artificial intelligence has enabled more sophisticated personalisation of teaching through educational applications based on the analysis of student behaviour and the prediction of their needs. For today's students and teachers, using augmented reality, interactive chatbots, big data analysis and other technologies in education is becoming a daily reality. Along with these opportunities, the risks and unintended consequences of using artificial intelligence in education are also revealed. These include issues related to ethics, security transparent use of data and social equality.

Artificial intelligence in higher education aims to optimise teaching processes and have a more effective form of interaction between students, teachers, and researchers. This goal can be achieved through personalised learning and assessment systems that provide individual feedback depending on the needs and aspirations of the student. The use of chatbots for a technical support system will reduce the administrative burden of educators and, at the same time, provide students with necessary information without delay. Artificial intelligence can be used to create simulations and virtual environments for hands-on learning. Virtual teachers and tutorials will support the flexibility of students' study schedules. And finally, artificial intelligence supports pedagogues when creating teaching materials and updating information. A prerequisite for the successful involvement of artificial intelligence in the teaching process is the consideration of ethical and security risks and preserving the quality of education and personal contact between students, teachers, and researchers.

The lack of personal interaction between students and teachers limits the essential aspects of the educational process, such as the possibility of discussing, mentoring, and individually supporting students. Decision-making and evaluation through artificial intelligence systems carry the risk of decisions based on prejudice, i.e., decisions promoting inequality and discrimination. Legitimate concerns about participants' privacy in the educational process relate to ensuring security in the collection, storage, and processing of data. The unintended consequences of incorporating technology into teaching range from the potential for misuse of technology by students to the unfair use of technology by educators to the disruption of the teaching and assessment process when the technology fails. They can also be found in the very essence of artificial intelligence: evaluations based on algorithms that can be complicated to understand may lack legitimacy. Finally, implementing artificial intelligence in education introduces economic costs and requirements on the initiative of education participants in the continuous acquisition and development of knowledge and skills necessary to effectively use technology.

1.1 A Sociological Perspective

Sociology deals with the social, cultural and political impacts of implementing technological innovations in the daily life of an individual actor and the entire society. Concerning its subject, it emphasises the topics of social inequality (social structures and stratification), work and unemployment (changes in the structure of the labour market, working conditions,

organisation of work due to robotisation and automation), cultural changes (changes in cultural patterns, patterns of communication as a reaction on the involvement of new technologies), social interaction and social ties, politics and participation of individual interest groups in decision-making, the impact of artificial intelligence on science, research and knowledge production (Broussard, 2018; Brynjolfsson, McAfee, 2014; Eubanks, 2018; Ford, 2015; Zuboff, 2019 etc.).

The issue of social impacts of artificial intelligence expands the knowledge developed within digital sociology, which covers a wider spectrum of social aspects of technology implementation and focuses on the study of interactions between society, social groups, and digital technologies in terms of their impact on social structures, relationships, culture, and identity (Orton-Johnson, Prior, 2013; Lindgren, 2018).

Although many studies address artificial intelligence's impact on society and its structure, relationships and elements, the sociology of artificial intelligence has not yet established itself as a separate scientific discipline. One of the reasons is possibly the multidimensional nature of artificial intelligence, which combines technical but also ethical, social, and cultural aspects, as well as economic and legislative aspects.

The sociological perspective of the use of technological innovations in teaching or in higher education emphasises the issue of the influence of technology on social interactions and dynamics and social equality. On the one hand, the personalisation of teaching makes it possible to consider students' individual needs and work with their diversity regarding aspirations, interests, values, norms, and cultural background. Additionally, the use of current technologies contributes to reducing barriers in access to education; study materials can be made available to anyone, anywhere, anytime through online course platforms and other flexible learning models. With new technologies, new tools for data analysis, investigation of social phenomena and development of methodological approaches also appear. Virtual community spaces can create bases for discussion, collaboration, and idea sharing among students, educators, and researchers.

On the other hand, there is a significant risk of biases embedded in AI algorithms and applications that can promote inequality and discrimination in access to education (Eubanks, 2018). Students with limited technological literacy, without access to technology or sufficient technological knowledge and skills, may be disadvantaged or excluded from the educational process. The risk also lies in the spread of new forms of non-substance addictions to technologies, which reflect negatively on the mental, psychological, and social levels. They are associated with increased stress and anxiety, problems with concentration and sleep, depression, and reduced self-esteem. Detachment from reality, offline social interactions and the social environment is linked to alienation due to limited opportunities to develop communication and social skills in general. Also unresolved are personal data protection issues and student privacy regarding data collection and use.

A sociological perspective could contribute to the formation of ethical and social norms in the field of artificial intelligence in education and everyday life in general.

1.2 Psychological Context

Artificial intelligence can provide personalised learning experiences that meet the learner's individual needs. Learning effectiveness increases when students see that they are learning exactly what they need to learn. Personalising learning materials and approaches to learning can help students feel more engaged and motivated. Motivation to learn is also enhanced by the virtual collaboration between students that AI can create. Group projects and online discussions can mediate an environment where students collaborate, share ideas and support each other. Support secures a greater desire to continue learning and pursue a learning goal. Using gaming elements and competitions can also motivate students in their learning. Here, artificial intelligence plays a vital role in creating interactive games. Interactive games encourage student engagement and reward them for achieving goals. If an environment is created to simulate various social and communication situations, students can develop skills such as teamwork, presentation, negotiation, etc. In this way they can gain valuable experience. With the ability to analyze large amounts of data, which AI can help with, students can identify patterns and relations in the data, which allows them to generate new ideas and innovative approaches and evaluate and combine them, which can lead to new and unconventional ideas, developing creativity.

Students create their personal goals and plans in the learning process. In this way, they can have a clear direction, motivating them to succeed. By setting personalised goals that the AI can create and remind students of, they can see their progress and how far they have come since they started learning. This also gives them positive feedback, which itself is a motivator in learning. Tracking progress with AI can also help identify areas where they need to improve. Artificial intelligence can provide immediate feedback to students on assignments and tests, allowing them to understand their mistakes more quickly. Feedback helps students better understand their strengths and areas they need to improve. Immediate feedback motivates them to develop further by providing advice, inspiration and ideas on improving and moving on.

During the learning process, large amounts of data can be generated with the help of artificial intelligence. Analysing this data helps identify patterns and trends in student performance, allowing for the creation of more effective teaching strategies. By analysing students' preferred learning styles and proficiency levels, AI creates personalised learning plans based on this information. This allows students to focus on their needs and improve their learning efficiency. Adaptive learning systems can analyze student performance and, based on this, suggest appropriate assignments and materials for further study. Adaptive tests adapt to the level and ability of the student. Tests can be designed to target specific areas in which the student needs to improve and provide immediate feedback (Kaplan, 2021).

In education, college students can utilise the help of virtual assistants who are equipped with artificial intelligence. These assistants can provide quick answers to questions, offer study materials, and help plan and organise assignments and exams or otherwise analyse their

requirements and problems. Virtual assistants can be available twenty-four hours a day, seven days a week and can be programmed to provide accurate and relevant information. Digital libraries where students have online access are also an essential source of information.

2 Artificial Intelligence from a Mental Hygiene Perspective

Self-control, the ability to plan or organise your time, plays a vital role in studying. Artificial intelligence can help students create and organise their time and study plans. With the help of various apps and tools for task and time management, students can keep track of their assignments and deadlines and do their work more efficiently. This can also prevent procrastination behaviour, which is very common among young people. In higher education, procrastination leads to academic failure and sometimes dropping out of education. In this context, drawing attention to mental hygiene and well-being is easy. Artificial intelligence can give students tools and techniques to manage stress and maintain balance. Apps for meditation and relaxation, chatbots for mental health support and other similar tools can help students manage stress and improve their overall well-being.

3 Conclusion

However, seeing AI as a supporting tool in the educational process is important. Regarding motivation, it is essential to realise that motivation is a complex and individualistic matter. Some students may use AI as a tool to motivate them, while others may prefer other approaches. It can be a valuable tool for setting the right learning strategies, for developing creativity etc. However, it should be borne in mind that it does not replace the role of the teacher, direct personal interaction with the teacher or with classmates, nor interpersonal social interaction and practice, nor does it replace the human support that is frequently needed to encourage the student. Therefore, other motivating factors and methods, such as personal interaction with teachers and classmates, must supplement AI. Remembering that AI is not a substitute for personal responsibility and discipline is also important. It is a tool that can provide support and assistance. The ultimate success in learning depends on the student alone and their ability to motivate herself, organize her time, and have a healthy lifestyle. Finding the right balance when using AI in education is necessary to achieve the best possible outcome for students.

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Interactive Applications Utilization in Teaching Mathematics

Milan Pokorný¹

DOI: <https://doi.org/10.53349/resource.2024.is1.a1254>

Abstract

Modern technologies have influenced the teaching of mathematics at primary schools, secondary schools, and universities. Nowadays, it is natural to utilise their advantages to reach teaching aims. It is widely known that mathematics should be taught to support students' active acquisition of knowledge. An appropriate use of interactive applications in teaching mathematics can contribute to this. In the paper, we present our own interactive applications that can be used in teaching mathematics at primary and secondary schools and universities. Moreover, we provide recommendations for their appropriate integration into education. Finally, we analyse our experience with integrating interactive applications into teaching mathematics at our faculty.

Keywords: Teaching mathematics, ICT in education, Interactive Applications

1 Introduction

Since the 1980s, modern technologies have influenced the teaching of mathematics at primary and secondary schools and universities. Initially, teachers tried to use computer programs to achieve a concrete educational goal. However, the importance of integrating modern technologies into education has gradually increased. Nowadays, it is natural that schools and universities use learning management systems to achieve educational goals.

There are many possibilities for how to integrate modern technologies into teaching. One of them is e-learning. There are many definitions of e-learning in the existing literature. By Wang et al. (2010), e-learning refers to the use of computer network technology, primarily over or through the Internet, to deliver information and instructions to individuals. However, most teachers who utilize modern technologies in education prefer a suitable combination of traditional face-to-face teaching and e-learning, making it possible to use the strengths of both teaching methods. In the scientific literature, this combination is referred to as blended

¹ Trnava University, Faculty of Education, Priemysel'ná 4, P. O. BOX 9, 917 01 Trnava, Slovak Republic.

E-mail: mpokorny@truni.sk

learning. It is often considered by many authors to be an ideal way how to integrate modern technologies into education. There are many reasons why teachers prefer blended learning over other educational methods. For example, Graham and Dziuban (2008) identified six reasons for using blended learning: the richness of pedagogical stimuli, access to knowledge, presence of personal contact, own control over learning, cost-effectiveness, and ease of control. According to Graham (2006), adopting a blended learning approach improves learning effectiveness, access and flexibility, resulting in greater cost-effectiveness. Fisher (2003) considers this modern method of learning to be a selection of an optimum mix of instructional delivery strategies. According to Thorne (2003), blended learning is the learning agenda's most logical and natural evolution.

As for mathematics teaching, many studies prove the suitability of blended learning. The study of Malatinská et al. (2015) demonstrated that blended learning positively impacts both learning outcomes and on attitudes of students towards mathematics. Similar results were published by Lin, Tseng, and Chiang (2016). Moreno-Guerrero et al.'s (2020) research shows a positive influence on results, grades, motivation, autonomy, and participation. Another proof of blended learning suitability in mathematics teaching can be found in the works of Mišút and Pokorný (2015), Pokorný (2019), and Voštinár (2017).

The importance of integrating modern technologies into education was fully demonstrated during the recent COVID-19 pandemic. Schools were closed in many countries, including the Slovak Republic, and distance education remained the only possibility for educating pupils and students. However, neither teachers nor students were sufficiently prepared for such a sudden transition to distance education. Modern technologies proved to be the most suitable option for distance learning. Teachers began to widely use synchronous and asynchronous forms of online education, thanks to which they could eliminate the negative impact of the COVID-19 pandemic on the achievement of educational goals.

After the end of the COVID-19 pandemic, many teachers returned to face-to-face teaching and stopped integrating modern technologies into education. On the other hand, thanks to the pandemic, many teachers have learned how to use modern technologies appropriately to achieve educational goals and continue to use them even after the end of the pandemic. It can be concluded that the pandemic contributed to integrating modern technologies into education and taught teachers and students to benefit from their advantages.

2 Interactive Applications

2.1 Active Acquisition of Knowledge in Teaching Mathematics

A traditional teaching of mathematics, in which a teacher gives pupils and students facts and knowledge in the form of an explanation and then practices it with them, is often criticised. The pupils often acquire facts and knowledge only at the level of memorisation, without deeper understanding, and therefore cannot use it when necessary. Nowadays, mathematics

teachers should prefer methods that lead to the active acquisition of knowledge by pupils. It is indisputable that the activation of students is very important in mathematics teaching. We must remember this when integrating modern technologies into teaching mathematics. Žilková (2013) states that it is necessary to concentrate on active acquisition of knowledge. Hanzel (2013) stresses that dynamics and interactivity are required in teaching mathematics. Moreover, he states that electronic study materials from mathematics should not be written in a classical way (definition, theorem, proof, and example). According to Mišútová and Mišút (2012), the didactic effectiveness of teaching increases if students have at their disposal interactive online courses in addition to face-to-face teaching.

However, how can modern technologies be integrated into teaching mathematics to support the active acquisition of knowledge by pupils or students? One possibility is the use of interactive applications that will allow students to actively solve tasks and react to their mistakes in such a way which allows them to correct their incorrect solutions. However, there is a lack of didactically processed interactive applications that mathematics teachers and their students could use.

A degree of interactivity of educational materials is one of the problems. Tasks considered interactive by their authors often only check whether the student's result is correct or incorrect. However, when solving mathematical problems, not only the result is important, but also the procedure by which the student obtained the result. An interactive application does not mean that it only checks whether the result is correct or incorrect. The interactive application should help the student to find the correct result after his/her wrong solution.

In Slovakia, we can find many interactive applications on the Internet. Many of them are created by the teachers themselves. However, most of these applications only check the correctness of the student's answer. In addition, the numbers in the tasks are not randomly generated, so when you run them again, the result is always the same. In case of applications from foreign websites, there is a language barrier, and especially pupils and younger students cannot work with them. These factors then reduce the effectiveness of using interactive applications in teaching mathematics.

2.2 Interactive Applications for Primary School Pupils

This part of the paper introduces our interactive applications for primary school pupils. The first group consists of interactive applications for students aged 6 to 11 in the field of combinatorics. They are available at <https://matematika.truni.sk/cvicenia?kombinatorika-1st-web>.

In these applications, students look for all the possibilities of how to buy fruits, dress robots, prepare a snack, roll the desired sum on the dice, create pairs, colour balls, snowmen or flags, etc. An example of an interactive application is depicted in Figure 1.

In the application depicted in Figure 1, a pupil must find all six ways how to colour a flag so that it has one blue, one red and one white stripe. Pupils know that there are six possible ways, but they have to find them. Figure 1 also shows feedback after a pupil's incorrect

solution. Flags that are the same are marked with a blue cross, and flags that do not meet the conditions of the task are marked with a red cross.



Figure 1: Interactive application Colour flags.

Controlling the applications is simple and intuitive. Pupils get used to it in a few minutes. For example, we control the application in Figure 1 by clicking directly on the stripes on the flag, which cyclically change colours in the order white - blue - red - white... If a pupil wants to check the correctness of his/her solution, he/she clicks the Check button and gets immediate feedback about the correctness of his/her solution. In case of an incorrect solution, after viewing the feedback, the pupil can continue solving the task and correct his/her mistake.

The second series consists of 34 interactive applications for solving word problems. In them, pupils practice solving word problems for various tasks based on addition, subtraction, multiplication, and division.

The series is available at <https://matematika.truni.sk/cvicenia?slovne-ulohy-1st-web>. An example of the application can be seen in Figure 2.


The application in Figure 2 is aimed at solving multiplication word problems up to $5 \cdot 5$. In the task in the figure, pupils solve the word problem: "5 children came to lunch. Each of them got four buns. How many buns did they get together?"

At the beginning, pupils see only the task. After entering the correct result, pupils continue solving the next task. After entering an incorrect result, a picture with buns (see Figure 2) is displayed as feedback, thanks to which pupils can correct their solution. All numbers in the tasks are randomly generated. Moreover, a teacher can see how many tasks were solved correctly and how many mistakes were made.

Slovné úlohy na násobenie do 5 · 5

Na obed prišlo 5 detí. Každé dostalo 4 buchty. Koľko buchiet dostali spolu?

Pomôž si obrázkami.



Počet správne vyriešených úloh: 1
Počet nesprávne vyriešených úloh: 1

Figure 2: Interactive application for multiplication up to 5 · 5.

2.3 Interactive Applications for Secondary School Students

In this part of the paper, we introduce our interactive applications for secondary school pupils. The first group consists of 38 interactive applications aimed at teaching decimal numbers. They are available at <https://matematika.truni.sk/cvicenia?desatinne-cisla-2st-web>. The applications cover the content and performance standard determined in the Slovak State educational program. Thanks to these applications, students will learn to write and compare decimal numbers, round decimal numbers, add, subtract, multiply and divide decimal numbers, determine the value of numerical expressions, solve word problems with decimal numbers, convert units of length, area, volume and weight, represent numbers on the number line and determine the arithmetic mean of decimal numbers.

In Figure 3, we can see an example of the application in which a student has to determine a number marked on the number line. In case of an incorrect answer, students receive a hint shown in Figure 4, thanks to which they can correct their solution.

Ktoré číslo je na číselnej osi na mieste otáznika?



Figure 3: Interactive application Representation of decimal numbers on the number line.

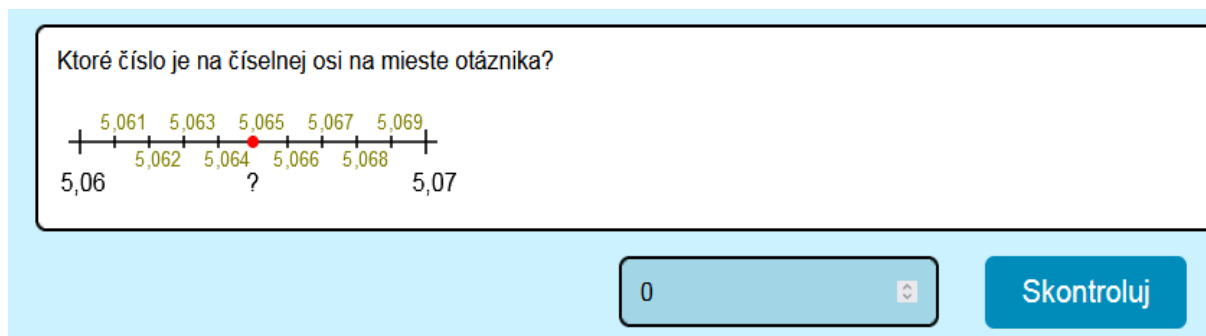


Figure 4: Feedback in the interactive application after an incorrect answer.

The second group consists of 19 interactive applications on the topic Variable, expression. They are available at <https://matematika.truni.sk/cvicenia?premenna-vyraz-2st-web>. Thanks to the applications, students learn to determine the value of an expression with one and two variables, use a formula to calculate the value of a variable, express a relationship between variables, express an unknown from a formula, add and subtract expressions with one and two variables, multiply an expression in parentheses by a positive and negative number, determine the coordinates of the point in the coordinate system and mark the point in the coordinate system.

The third group consists of 24 interactive applications on the topic Ratio, Direct proportionality, and Inverse proportionality. They are available at <https://matematika.truni.sk/cvicenia?pomer-2st-web>. Thanks to the applications, students learn to write a given ratio in equivalent forms, increase or decrease a quantity in a given ratio, divide a quantity in a given ratio, and solve word problems with ratio, direct proportionality, and inverse proportionality.

2.4 Integration of Interactive Applications into Teaching

In the previous part, we describe five groups of interactive applications for teaching mathematics of pupils aged 6 to 15. In our opinion, the advantages of integrating the applications into teaching mathematics are:

1. Applications have a wide range of utilization. Firstly, it is possible to use them directly during a lesson. For example, on an interactive whiteboard, a teacher can use an application depicted in Figure 1 to demonstrate a suitable way of solving the given combinatorial task (for example, both flags in the first row have the first stripe blue, both flags in the second row have the first stripe red, both flags in the third row have the first stripe white). Secondly, pupils can work with applications on tablets or notebooks during the lesson. Thirdly, pupils can work with applications in the school children's club, during a lesson with substitute teacher, during preparation at home, etc. Of course, we recommend that when working with applications, each pupil has his/her own device.

2. As we have already mentioned, it is known that pupils learn much more if they acquire knowledge by an active way, not by writing down solutions of classmates or the teacher. If pupils are working on their own notebook or tablet, they are forced to work and solve problems actively.
3. The applications provide pupils with immediate feedback about the correctness of their solution during their work. If pupils' solution is incorrect, they can correct it. We consider this to be an advantage, especially when a pupil is doing homework since the application itself checks the correctness of the homework solution (there is no such feedback when solving the homework in a printed worksheet).
4. The applications support the pupil's own pace of work. Each pupil works at a different speed; some only solve the third task, and others are already on the seventh. In this way, it is achieved that the slower students catch up, while the faster ones do not have to wait for anything and are also active all the time.
5. Applications support an individual approach to pupils. For example, a pupil with trouble with addition up to 10 can work with this application, while another pupil may already be working with an application focused on addition up to 20.
6. Applications can be run on many different devices (computers, laptops, tablets, and mobile phones) with Windows, macOS, Android, iOS and other operating systems with supported browsers.
7. As mentioned earlier, the applications randomly generate numbers in the word problems, so the results do not repeat when returning them. So, it is not enough to remember that the task with the buns from Figure 2 has a consequence of 20 because when you start it again, the numbers (and thus also the result) could be different.
8. The applications can be used during a group work of pupils. For example, a pupil who no longer has a problem with the application works with a classmate and helps him/her.

2.5 Interactive Applications for University Students

At our faculty, we prepare future teachers at primary and secondary schools. The largest group of student's study Pre-School Elementary Pedagogy. After their bachelor's, they can become teachers at kindergarten or continue a master's study in Primary Education Teaching to become teachers at primary schools.

They must complete the course Combinatorics and Working with Data during their study. The course is taught by blended learning, a combination of face-to-face lessons with a teacher and an e-learning course in Moodle. There are two groups of students. Full-time students have one face-to-face lesson every week; part-time students have an introductory online lesson and an online consultation at the end of the term. In a group of full-time students, we use a flipped classroom. In Moodle, students have video lessons, and every week, they have to study one of them before a face-to-face seminar, where the content of the video lesson is practised. A video recording of a workshop is available in Moodle for both full-time and part-time students for further use.

To make our students more active, we prepared a series of 62 interactive applications from combinatorics (one of them is depicted in Figure 5), four applications from probability and seven applications from descriptive statistics. The applications are available for students in Moodle. The combinatorics applications focus on the systematic solutions of combinatorial tasks by finding all possible combinations, variations, and permutations. Thanks to the applications, students have immediate feedback about their knowledge level after studying video lessons in Moodle.

Úloha: V obchode majú 3 druhy ovocia. Nájdite všetky možnosti, ako môžeme kúpiť štyri kusy ovocia.

1.možnosť

2.možnosť

3.možnosť

4.možnosť

5.možnosť

6.možnosť

7.možnosť

8.možnosť

9.možnosť

10.možnosť

11.možnosť

12.možnosť

13.možnosť

14.možnosť

15.možnosť

16.možnosť

17.možnosť

18.možnosť

19.možnosť

20.možnosť

21.možnosť

22.možnosť

23.možnosť

24.možnosť

Zmaž posledný rad

Skontroluj

Výborne!
Riešenie je úplne správne.

Ovládanie:
Ovocie vložíte kliknutím na obrázky s ovocím v pravom hornom rohu. Vložené ovocie meníte aj klikaním na neho.
Tlačidlo "Zmaž posledný rad" zmaže ovocie v poslednom rade.
Tlačidlom "Skontroluj" získate spätnú väzbu o správnosti a úplnosti riešenia.

Figure 5: Example of an interactive application from combinatorics.

In an interactive application in Figure 5, the students have to solve the following problem. The store sells apples, pears and pineapples. Find all the possibilities of how four pieces of fruit can be bought. As we can see, there are many possibilities for finding the correct solution. The application recognises all correct solutions. If the solution is incorrect (some possibilities are missing, some of them are duplicates), students have immediate feedback, and they can correct their solution as many times as necessary.

To determine students' opinions on the teaching method mentioned above, we used a questionnaire, which 97 full-time and 167 part-time students filled out.

In the first question, we investigate whether our students consider the video lessons in Moodle to be helpful. Students chose an answer from 1 to 5, where one meant "not useful at

all" and five meant "very useful". Out of 97 full-time students, 90 chose option 5, 5 chose option 4, and only one chose options 1 and 2. Out of 167 part-time students, 160 chose option 5, 6 chose option 4, and only one chose option 1.

In the second question, we investigate whether our students consider the course in Moodle with interactive applications to be useful. Again, the students chose an answer from 1 (not useful at all) to 5 (very useful). Out of 97 full-time students, 76 chose option 5, 13 chose option 4, 6 chose option 3, and only two students chose option 2. Out of 167 part-time students, 148 chose option 5, 15 chose option 4, and only three students chose option 3.

In the third question, we investigate whether our students consider the text documents (in pdf or docx format) in our course in Moodle to be useful. Out of 97 full-time students, 73 chose option 5, 14 chose option 4, 8 chose option 3, and only one student chose option 2. Out of 167 part-time students, 141 chose option 5, 12 chose option 4, 11 chose option 3, and only two students chose option 2.

In the fourth question, we investigate whether our students consider their final evaluation from Combinatorics and Data Processing to be objective. Students chose an answer from 1 (it is not objective at all) to 5 (it is really objective). Out of 97 full-time students, 80 chose option 5, 11 chose option 4, and 6 chose option 3. Out of 167 part-time students, 149 chose option 5, 11 chose option 4, 4 chose option 3, and only one chose options 1 and 2.

In the fifth question, we investigate whether our students are satisfied with their final evaluation from Combinatorics and Data Processing. Students chose an answer from 1 (I am not satisfied at all) to 5 (I am very satisfied). Out of 97 full-time students, 80 chose option 5, 6 chose option 4, 10 chose option 3, and only one student chose option 2. Out of 167 part-time students, 133 chose option 5, 18 chose option 4, 9 chose option 3, 2 chose option 2, and three chose option 1.

Finally, in the sixth question, the students were asked to rate a teaching of Combinatorics and Data Processing. They had to use a scale from A (best grade) to FX. Out of 97 full-time students, 65 chose option A, 29 chose option B, 2 chose option C, and only 1 student chose option D. Out of 167 part-time students, 147 chose option A, 13 chose option B, 6 chose option C, and only one student chose option D. No student chose options E or FX.

3 Conclusion

Nowadays, our children use mobile phones and tablets daily. Computer rooms, interactive whiteboards and tablets are gradually increasing in our schools. Therefore, it is natural to use these devices in teaching mathematics, starting from the first grade of primary school. However, it is necessary to mention that these devices do not automatically improve the educational process. There is a need for high-quality didactic software which will contribute to the achievement of educational goals.

There are many interactive applications for teaching mathematics on the Internet. However, most of them are not in the Slovak language, which causes a language barrier for

our primary and secondary school students. Naturally, it is impossible to assume that they fully correspond to the requirements in the Slovak State educational programme. We are convinced that our applications described above could contribute to the efficient achievement of teaching aims since they make pupils and students achieve knowledge in an active way. Moreover, working with our applications respects the student's own pace and level of knowledge. Unfortunately, we did not have an opportunity to test the efficiency of the above-mentioned applications at primary and secondary schools. However, we tested the effectiveness of our older applications, which positively impacted not only pupils' knowledge but also their positive attitude towards mathematics (see Malatinská et al., 2015). Therefore, we welcome collaborating with primary and secondary school teachers on implementing such research.

We know that our applications are currently only available in Slovak. We plan to add English or Czech versions in the future.

As for the utilisation of interactive applications in teaching mathematics at our faculty, their integration into education has brought several positives. As we have mentioned above, the majority of both full-time and part-time students were really satisfied with our method of teaching, which combines video lessons, texts, interactive applications and face-to-face teaching. Nearly all students agreed that the Moodle course with interactive applications was helpful. Although video lessons were the most popular, interactive applications were also highly valued. Our research also revealed a positive impact on students' feelings of objectiveness in their final evaluation. We state that this is also due to the use of interactive applications that give students accurate and reliable feedback about their level of knowledge. It is also necessary to mention that most students are satisfied with their final assessment, which is not always obvious when teaching mathematical subjects. Finally, the evaluation of our teaching method using interactive applications by our students, where more than 80 per cent of students used the best grade A, shows their satisfaction. Let us note that such assessment is not usual in teaching mathematical subjects.

Acknowledgement

The paper was supported by the KEGA 001UMB-4/2023 project entitled Implementation of Blended Learning in the Training of Professional Bachelors and Teachers of Mathematics and Computer Science and by the KEGA 004TTU-4/2021 project entitled Teaching Mathematics and Computer Science Using Interactive Components.

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New Trends in E-learning and New Approaches to the Development of E-learning Educational Materials

Katarína Pribilová¹, Miroslav Beňo¹

DOI: <https://doi.org/10.53349/resource.2024.is1.a1255>

Abstract

E-learning represents an area that is dynamically developing and closely correlated with society's technological progress. Since its inception, we have witnessed many changes in e-learning development and the creation of electronic educational materials. With the growing development of modern technologies, E-learning is becoming a key element in education. This article aims to identify and describe the main trends in e-learning and the creation of electronic educational materials. As part of our survey, we identified the main trends shaping E-learning. These trends include various aspects, including the personalisation of education, the interactivity of courses, the use of artificial intelligence and data analysis for better efficiency, the development of virtual reality and augmented reality in the educational environment, the inclusion of various multimedia elements, and many others. We expect these trends to have a significant impact on the way educational materials are created and delivered. They open the door to new possibilities and innovations in the E-learning field, which promise a more effective and adaptable education for everyone.

Keywords: E-learning, Microlearning, Artificial intelligence, Adaptive learning, Gamification, Mobile learning

1 Trends in E-learning

E-learning is an increasingly popular form of education that plays a significant role in both traditional education and professional development, offering flexibility and accessibility to a

¹ University of Ss. Cyril and Methodius in Trnava, Faculty of Natural Sciences, Institute of Computer Technologies and Informatics, Nám. J. Herdu 2, 917 01 Trnava.

E-mail: katarina.pribilova@ucm.sk

wide range of learners. The eLearning market has grown exponentially over the past few years. Many companies have realised the importance of providing quality training to employees. With new technologies, companies seek ways to improve and modernise their training courses.

In the rapidly developing world of education, eLearning trends are changing how we approach teaching and learning (Enache, Maria, 2023), (Alfaro et al., 2021). Several key trends are emerging that promise to revolutionise the learning environment.

The first trend is *blended learning*, a *hybrid approach to education*. On-demand and instructor-led learning are combined into a coherent and unified training strategy. Using a blended model requires a balance between traditional instructor-led instruction, autonomous self-study, and eLearning (Shetu et al., 2021). Using this fusion of teaching approaches has many advantages, the most important of which is that it adds flexibility to business education. *Personalisation* is another trend that is inevitable because every student learns differently. However, personalisation must consider each individual's needs, requirements, learning goals, skill level, and learning abilities to be effective. The personalisation process should also use a progress monitoring mechanism for verification (Murtaza et al., 2022).

Augmented Reality (AR) and *Virtual Reality (VR)* bring intense immersion and more effective learning to eLearning. These technologies provide a safe environment for students to perform risk-free simulations and exercises. Professionals in heavy machinery, construction workers, health workers, and first responders can use AR and VR in training, allowing the practice of processes without real risks (Alfaro et al., 2021). Simulations in AR and VR keep students' attention and provide an effective learning environment. Both technologies are helpful for training and game training, overcoming the original limitations and providing immersive and interactive learning.

Currently, *Microlearning* and *Nano-learning* are coming to the fore. Microlearning involves teaching one objective per lesson, separating essential information, and taking various formats, including quizzes, videos, and gamification elements (Leong et al., 2021). In contrast, nano learning is an even shorter concept, with lessons lasting only 3-5 minutes, making it easier and more flexible for students with limited time to stay focused.

Even artificial intelligence has its place in the e-learning field (Domalis et al., 2022). Using machine learning and algorithms, artificial intelligence identifies users' strengths and weaknesses, enabling training content to be customised (Muniasamy et al.; A., 2020).

Another trend that persists in the field of e-learning is *gamification*. This strategy uses game elements such as points, levels, rewards, competitions and collaboration to increase student interest and participation (Khaldi et al., 2023). Given these advantages, gamification in e-learning is an increasingly popular approach to improve engagement, student motivation and results. However, it is essential to remember that the game elements are well-designed and included in the educational content in such a way that they support the learning objectives and do not distract from the learning itself.

In case you are dealing with eLearning and creating courses for students, it is crucial to ensure that you create a user-friendly mobile platform. Nowadays, many people prefer to use their smartphones when searching for educational opportunities, so it is crucial to adapt to this trend. When potential students come to your course and find it is not mobile-optimized, they may be inclined to look elsewhere for alternatives. A mobile approach to course design is the best way to ensure their needs are met.

Data analytics is vital in eLearning, especially in corporate and higher education (Liu et al., 2023). Predictive analytics uses historical data to predict future student behaviour, often through artificial intelligence (AI) that analyses collected data and generates reliable forecasts. This approach can significantly increase the effectiveness of learning. Data analysis allows redirecting students to materials that best match their preferences and promotes faster and more effective learning. It can also identify a drop in performance and notify the instructor, allowing him to provide early assistance to the student.

2 Electronic Educational Materials

The creation of electronic materials for e-learning is also developing by current trends in technology and education. Creating e-learning courses often follows the traditional ADDIE (Analysis, Design, Development, Implementation, Evaluation) model (Figure 1), which includes analysis, design, development, implementation, and evaluation (Kruse, 2002), (Branch, 2010).

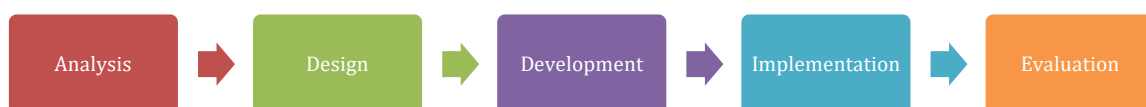


Figure 1: The traditional ADDIE Model (Source: authors)

Analysis of needs and target groups is a crucial step in developing e-learning material. This process serves to verify the need for e-learning to supplement existing knowledge and skills and, at the same time, determine whether e-learning is the most appropriate solution. The analysis of needs also enables the identification of the general objectives of the course. A crucial next step is the analysis of the target group, where key characteristics of the students are taken into account, such as their previous experience, skills and access to technology (Drljača et al., 2017).

Furthermore, it is necessary to define the course content and the tasks that will lead to acquiring or improving the student's knowledge and skills. Topic analysis is needed to identify and classify course content, ensuring the electronic material is targeted and effective in achieving learning objectives. In this way, it is ensured that the development of e-materials

will be adequately adapted to the target group's needs and meet the defined educational goals (Almelhi, 2021).

The *design phase* of creating e-learning materials involves formulating the learning objectives needed to achieve the general course objectives, defining the optimal order of these objectives, and creating a course structure (Allen, 2006). In addition, appropriate learning strategies, communication methods and assessment procedures are selected. The result of this phase is a detailed plan that serves as a recommendation for further course development and includes the organisation of lessons, chapters, activities, learning objectives for each unit, teaching methods, communication tools and assessment tools. This plan provides a clear framework and guides the overall process of creating e-materials (Spatioti et al., 2022).

In the *development phase*, the content of the course is created, which is subsequently enriched with multimedia elements. Creating interactive multimedia content includes the following steps: gathering materials and information, writing content integrating teaching methods and multimedia elements, developing media and interactive components, and finally, completing the course in various formats (Arkün & Akkoyunlu, 2008). In this way, it is ensured that the course contains relevant and exciting elements that promote effective learning and student engagement (Drljača et al., 2017).

In the *implementation phase*, the course is delivered to students. The e-course is integrated into the learning management system (LMS) and available to students. The education process occurs under a tutor's guidance, who ensures students' management and support. This stage includes activities related to managing and facilitating the educational process for students, thus ensuring the practical course and achievement of educational goals (Drljača et al., 2017).

Evaluation in the learning process can include evaluating student responses and achievement of learning goals. This includes evaluating student feedback and evaluation of the content and teaching methods. At the same time, it is evaluated whether the set educational goals have been achieved and what level of understanding and mastery the students have demonstrated. Evaluation is a crucial tool for evaluating the educational program's success and provides information for further improvements and adaptations of content or methods according to students' needs (Drljača et al., 2017).

2.1 Quality of Electronic Study Materials

When creating electronic learning materials, paying attention to several essential aspects that can significantly affect the success of achieving educational goals is crucial. These aspects include the content itself, the interaction with students, and the creation of an environment that supports effective learning (Clark & Mayer, 2023), (Clark & Mayer, 2005).

The quality and relevance of the content are the key basis for successful learning through electronic materials. These aspects include not only the accuracy of the information but also

its compliance with the current trends and needs of the educational environment. A key element of quality educational material is the accuracy of the information provided. The content should be based on reliable sources and professional knowledge so that students can acquire reliable knowledge. The world of education and information is constantly changing. Therefore, the content of the materials must reflect the latest knowledge and research in the relevant field. Good content should be clearly and logically structured, allowing students to learn systematically and effectively. The hierarchical arrangement of topics and their interconnections are essential for overall understanding. Each educational material should be designed with specific learning objectives in mind. Content should be directly linked to expected outcomes so that students achieve the required levels of knowledge. Given the complexity of many topics, e-learning materials should support interdisciplinary perspectives that provide broader context and understanding. The content should be formulated clearly and comprehensibly for the target group. Using language that is accessible and suitable for students contributes to effective learning. Appropriate use of different materials (texts, visuals, auditory elements) increases students' interest and allows them to learn according to different styles (Morrison, 2003).

Interactivity in electronic learning materials is a key element that can enrich the learning experience and increase student engagement. Implementing interactive exercises and activities allows students to immediately apply learned information and develop practical skills (Kuatbekov et al., 2023). These activities may include questions, assignments, quizzes or programming tasks, depending on the nature of the learning content (Clark & Mayer, 2023). User-friendly design is another key element of e-learning materials. The design should be simple and easy to understand. Navigation elements should be intuitive and easily accessible. The learning environment should be adapted to different devices and screen sizes (responsive design). This will allow pleasant access to materials not only on computers but also on tablets or mobile devices. Using appropriate colours and contrasting elements supports legibility and increases visual friendliness. The contrast between the text and the background should be sufficient to make the text easy to read.

Personalisation of learning is an essential aspect of e-learning materials that allows content and teaching methods to be adapted to students' individual needs and preferences. Implementing adaptive learning systems that track student progress and automatically adapt content based on their abilities and needs. Creating opportunities for students to create and customise their study plans following their goals and preferences. This includes choosing specific topics, assignments and other learning resources (Tangirov et al., 2021).

Multimedia content is critical to e-learning materials because it adds variety and interactivity to the learning experience. The written text provides elemental information and structure. Clear and comprehensible text is vital for presenting information and creating a foundation for other multimedia elements. Visualisations such as pictures, graphs, and diagrams can promote a better understanding of abstract concepts and emphasise key points

(Kuatbekov et al., 2023). Visual representation of information can be beneficial for visually oriented learners. Videos enable dynamic presentation of information, demonstration of procedures and display of real situations. Video content can be engaging and support learning through visual and audio elements. Audio elements such as spoken words, music, or sound effects can add to the atmosphere and emphasise specific points. Audio can be helpful for auditory learners. Simulations and interactive models allow students to experiment with specific concepts and observe their impact in real time. This multimedia content is especially useful in teaching science and technology subjects. Animations can explain movement and processes that would be difficult to understand with only static images. Dynamic animations can create visual appeal (Kuatbekov et al., 2023). Multimedia content makes it possible to appeal to different learning styles and preferences. Students can choose the content that best suits their needs (Clark & Mayer, 2005), (Morrison et al., 2001).

Implementing virtual reality (VR) in e-learning materials is increasingly emphasised. Students can take virtual tours of historical places, laboratories, or different environments to visualise theoretical concepts better. Virtual simulations can enable practical exercises in a safe environment. VR can be used to create interactive learning materials where students can physically interact with objects and information in 3D space (Wang, 2020). VR in adaptive learning environments enables a personalised approach to education according to students' needs. It can contribute to a better understanding of the subject matter, increase student engagement, and provide realistic learning experiences (Zhang, 2023).

Effective assessment and feedback mechanisms are critical for assessing student progress and providing guidance for further improvement. The assessment should be fair, consistent, and focused on clear criteria. Quality assessment helps students understand how well they have met the objectives and where they may be lacking. Using diverse assessment forms, such as tests, projects, portfolios, discussions, and practical tasks, allows for a more comprehensive assessment of students' abilities. Providing immediate feedback to students allows for a quick understanding of their performance and the opportunity to improve immediately. E-learning materials can offer automatic feedback on online tests or exercises. Using technological tools allows the automation of some assessment processes, which can save time for teachers and allow for quick feedback to students. Involving students in the assessment process, for example, through self-assessment or peer assessment, can encourage more active participation and critical thinking (Clark & Mayer, 2005), (Morrison et al., 2001).

3 Tools for Creating Electronic Educational Materials

Authoring tools for creating electronic educational materials offer various possibilities for creators of courses and teaching materials. Most authoring tools allow you to insert interactive elements such as quizzes, simulations, games, drag-and-drop activities, and more.

This increases the engagement and interactivity of the content. Course creators can integrate a variety of media formats, including images, videos, sounds, and animations, to enrich content and facilitate understanding. Many tools provide predefined templates and scenarios, simplifying content creation and saving time. Some authoring tools support the creation of courses with a responsive design, ensuring the content is optimised for display on different devices. Course creators can use tools to track student progress and assess and evaluate course effectiveness (Georgarakou, 2023).

Some tools can integrate with existing learning management systems (LMS) or other platforms, allowing for easy content distribution. The ability to create content that adapts to the student's ability level and enables a personalised experience. Authoring tools involved text, images, audio, video, or animations. Some tools allow course creators to collaborate and share their content with others through cloud services or other means. Providing analytical information about student performance and course effectiveness to enable creators to understand better and adapt their content. The choice of a specific authoring tool depends on the individual needs, technical knowledge and preferences of the course creator or instructor (Penfold, 2023).

Figure 2 shows a brief overview of the characteristics of tools for creating electronic educational materials

Articulate Storyline

- Professional tool for creating interactive e-learning courses.
- Ability to create content without programming with rich interactive elements.
- Support for various media formats, including images, videos and audio.
- It contains predefined templates and scenarios, which simplifies the creation of courses.
- The courses are compatible with different devices and offer tracking of student progress.

Adobe Captivate

- An excellent tool from Adobe for creating interactive courses without technical knowledge.
- Ability to insert various interactive elements such as quizzes, games and simulations.
- Support for the creation of simulations and software training for students' practical experience.
- Responsive design for optimizing courses on different devices.
- Integration with Adobe Creative Cloud for easy content sharing.

Kahoot!

- An interactive tool for creating quizzes and games in a simple and fun environment.
- Ability to create quizzes in real time, support for mobile applications.
- Players are scored for quick and accurate answers, stimulating quick reactions.
- "Jumble" function and the possibility of assigning homework through quizzes.
- Wide use in schools, training and educational events.

H5P

- Open-source tool for creating interactive content types.
- Flexibility and easy integration with various online platforms and LMS.
- A wide range of interactive content types, including quizzes and presentations.
- Compatibility with various devices and support for responsive design.
- Content personalization and student progress tracking.

Lectora

- A high-performance tool for creating e-learning courses with a rich set of interactive elements.
- The possibility of creating complex scenarios and branching for a personalized experience.
- Integration with SCORM and xAPI standards for tracking student activity data.
- Use of HTML5 technology for compatibility with modern browsers and devices.
- It provides analytical tools and customizable templates for course monitoring and evaluation.

Figure 2: Overview of the characteristics of authoring tools

The choice of a tool for creating e-learning courses should be based on the specific needs and preferences of the course creator or organisation. Some tools may focus on creating quizzes and interactive elements more straightforwardly, while others provide more advanced capabilities for scripting and creating complex e-learning materials.

4 Research in the Creation of Electronic Study Materials

Our research evaluated e-learning study material in Introduction to the Study of Computer Science. Students could use this study material as additional material during their studies.

During the survey, we focused on the quality of processing the electronic course from the point of view of the student's needs. Students in the first year of applied informatics participated in the survey in full-time and part-time form, with 63 respondents. The questionnaire contained closed questions to which the respondents answered according to their agreement or disagreement on a 5-point Likert scale ranging from "1 – strongly disagree", "2 – disagree", "3 – neither agree nor disagree", "4 – agree" to "5 – I strongly agree". Table 1 presents a selection of questions considered for course modifications.

Table 1: Questionnaire survey and respondents' results (%)

The wording of the question	1	2	3	4	5
The teaching text in e-learning study material was formulated in a comprehensible way.	0	5	17	19	59
Using illustrative materials, including graphs, tables, and animations, enhanced my comprehension of the subject matter.	0	0	4	24	72
The self-tests made available in the study materials gave me good feedback on my progress in the study.	0	0	8	46	46
The e-learning study material platform featured user-friendly navigation and readily accessible information.	0	0	22	45	33
Were the examples in the study materials sufficient for a thorough understanding of the subject matter?	10	15	20	27	28
In your opinion, would the inclusion of multimedia elements such as videos and animations increase the overall quality of the study materials?	0	0	7	12	81

The evaluation of the survey results indicates a significant positive response from the respondents regarding various aspects of the study materials and their impact on the understanding of the subject matter. A large majority of respondents (78%) expressed a positive opinion on the comprehensibility of the teaching text in the e-learning study material. A minority of respondents (22%) expressed a neutral attitude (neither agreement nor disagreement) or disagreed with the statement, which may indicate a slight discrepancy in opinions about the formulation of the teaching text (Chart 1). Overall, the positive assessment of the comprehensibility of the learning text can be considered encouraging. However, it is crucial to continue to monitor and adapt the content based on user feedback. Using illustrative materials, including graphs, tables, and animations, improved most respondents' understanding of the curriculum (Chart 2). Up to 72% of respondents ultimately agreed that using illustrative materials, including graphs, tables, and animations, significantly improved their understanding of the study material.

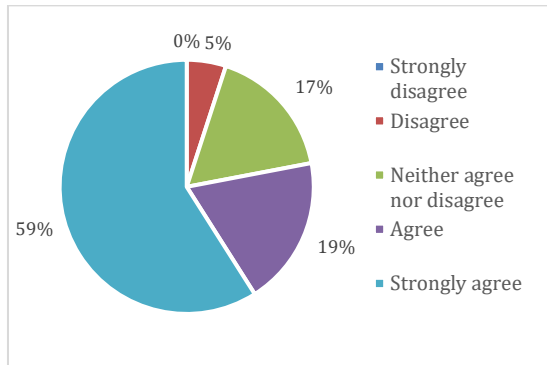


Chart 1: The teaching text in e-learning study material was formulated in a comprehensible way.

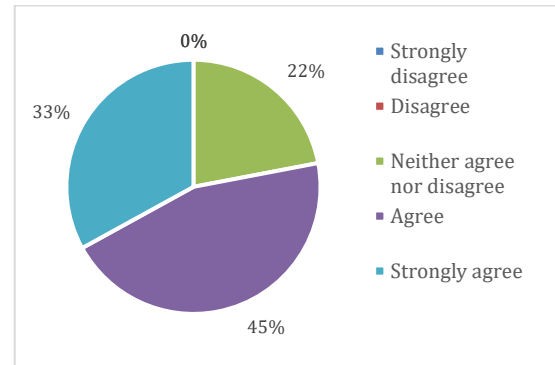


Chart 4: The e-learning study material platform featured user-friendly navigation and readily accessible information.

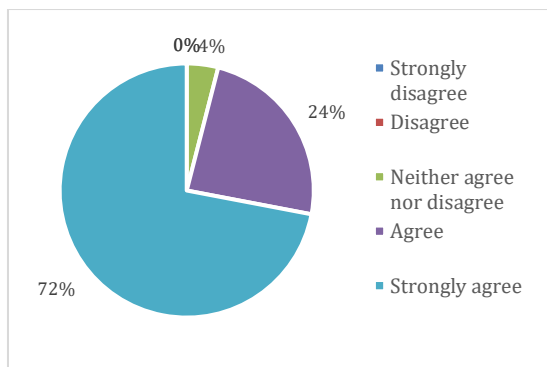


Chart 2: The utilisation of illustrative materials, including graphs, tables, and animations, enhanced my comprehension of the subject matter.

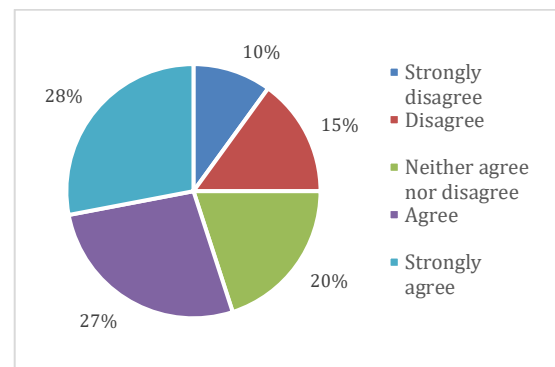


Chart 5: Were the examples given in the study materials sufficient for a thorough understanding of the subject matter?

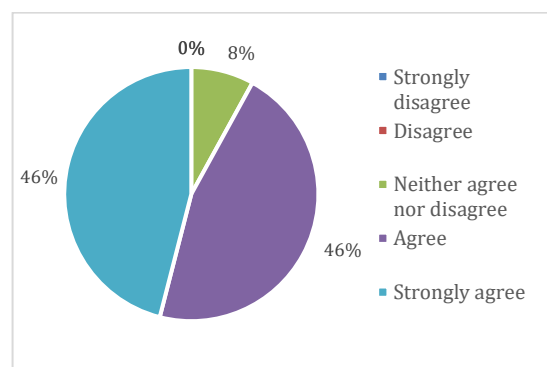
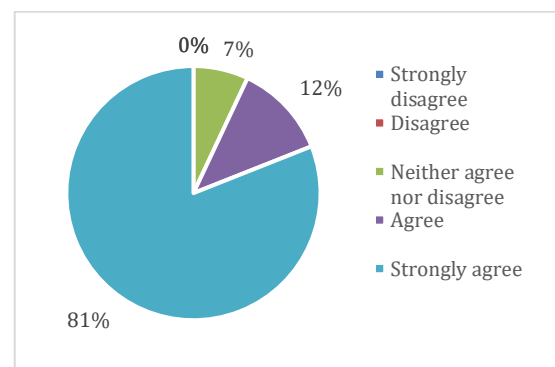


Chart 3: The self-tests made available in the study materials gave me good feedback on my progress in the study.



Charts 6: In your opinion, would the inclusion of multimedia elements such as videos and animations increase the overall quality of the study materials?

Self-tests in study materials provided positive feedback on study progress for most respondents. More than three-quarters of respondents (78%) agreed (fully or partially) that the self-tests in the study materials provided good feedback on their progress in their studies (Chart 3).

The e-learning study material platform was largely considered user-friendly with easily accessible information. Most respondents (92%) were satisfied with user-friendly navigation and easy access to information on the e-learning platform (Chart 4).

There is a diverse opinion on the sufficiency of the examples in the study materials, with 47% of respondents agreeing (fully or partially) and 25% disagreeing (fully or partially) with the statement that the examples were sufficient (Chart 5). The finding indicates that some respondents think that the examples in the study materials could have been presented better. Most respondents are convinced that including multimedia elements such as videos and animations would significantly increase the overall quality of study materials (Chart 6). The majority of respondents (93%) believed that including multimedia elements such as videos and animations would significantly improve the overall quality of study materials.

The fact that our findings are in line with other studies in this area (Elango et al., 2008), (Martínez-Caro et al., 2015), (Pham et al., 2019) reinforces their importance and gives them a wider context. This confirmation can promote confidence in the quality and effectiveness of electronic learning materials (Ginns & Ellis, 2009). It is helpful to identify specific areas that generate disagreement or neutrality. Overall, the positive evaluation of the e-learning material can be considered encouraging, but it is essential to continue to monitor and adapt the content based on user feedback.

5 Conclusion

E-learning has become an integral part of modern education and professional development, while its popularity continues to grow. With the rapid advancement of technology, the way we approach education is also changing, and new trends in e-learning promise to revolutionise teaching methods.

Blended learning, personalisation, augmented reality, virtual reality, microlearning and nano-learning, artificial intelligence, gamification, mobile access, and data analysis are among the key trends shaping the current form of e-learning. These trends bring flexibility, interactivity, and a personalised approach to education.

When creating e-learning materials, paying attention to content quality, interactivity, user-friendly design, and personalisation of learning is essential. Authoring tools for creating e-learning courses provide creators with various options for creating attractive and effective educational content.

In today's dynamic world of education, it is crucial to constantly monitor new technological innovations and adapt to the changing needs of students and organisations. E-learning,

supported by modern technologies and innovative approaches, can transform learning and development.

Acknowledgement

This research was funded by the grant KEGA 017UCM-4/2022. An interactive e-course using “SMART” technologies was developed to develop algorithmic thinking and programming skills.

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Dance of Data in Pedagogical Research

*Peter Pšenák*¹

DOI: <https://doi.org/10.53349/resource.2024.is1.a1256>

Abstract

This conference paper concentrates on the exploration of the interplay between statistics, probability distributions, t-tests, and the utilisation of the R language in pedagogical research. Statistics play a vital role in collecting, analysing, and interpreting data in educational research. The t-test, as a fundamental statistical tool, enables researchers to assess the significance of differences between groups, a common requirement in pedagogical studies. The integration of the R language, a powerful and flexible statistical computing tool, empowers researchers to conduct complex analyses efficiently. It acts as a bridge between statistical theory and practice, enabling the application of statistical methods to real-world educational data. This paper sheds light on the systematic approach to employing these elements, emphasising their practical importance in pedagogical research.

Keywords: Education, Research, R, Statistics, T-test

1 Introduction to Statistical Analysis in Educational Research

Statistical analysis is a critical component of educational research, playing a pivotal role in understanding, interpreting, and drawing conclusions from data collected within educational settings. Its importance lies in its ability to provide a systematic framework for researchers to analyse and interpret complex educational data, easing decision-making processes and shaping educational policies.

Statistical analysis is paramount in educational research due to its wide-ranging applications from evaluating teaching methods and student performance to examining socioeconomic influences on learning outcomes. Statistical analysis is a crucial tool for achieving the intended outcomes (Ary et al., 2018).

Educational research faces a significant challenge due to the overwhelming volume of published studies, increasing the complexity of conducting systematic reviews (Newman & Gough, 2020). Over recent years, the field has witnessed a surge in literature, coinciding

¹ Comenius University in Bratislava, Faculty of Management, Odbojárov 10, Bratislava.

E-mail: peter.psenak@fm.uniba.sk

notably with the disruptive impact of the COVID-19 pandemic on education worldwide (Abumalloh et al., 2021; Baker, 2020).

The pandemic prompted rapid and extensive changes in educational approaches, with a current trend leaning towards reinstating pre-pandemic educational norms. It acted as a catalyst for exploring innovative educational models like the flipped classroom (Szóköl et al., 2023) while emphasising the urgency of understanding students' psychological well-being (Ebrahim et al., 2022).

Statistical analysis in educational research involves using statistical tools to understand and interpret data collected in educational studies. Researchers use techniques like descriptive statistics to summarise data characteristics, inferential statistics to make predictions about larger populations, and experimental design to assess the effectiveness of educational interventions. This analysis helps identify trends and relationships between variables and assess the impact of teaching methods or policies. It also aids in survey analysis, tracking changes over time, and handling large educational datasets to derive evidence-based conclusions that inform educational practices and policies (Ary et al., 2018; Peck et al., 2020).

However, there are instances where educational research appears daunting, often resulting in a lack of enthusiasm among individuals. Quantitative research methodologies can seem challenging, with terms like hypothesis creation and testing evoking a sense of apprehension. This article aims to shift this perception by introducing accessible research methodologies and showing user-friendly approaches within educational research.

2 Fundamentals of Probability Distributions

Probability distributions form a foundational concept in educational research, serving as essential tools to understand and interpret data variability and uncertainty. In simplest terms, a probability distribution represents the likelihood of different outcomes in each scenario. In education, these distributions aid in modelling and analysing various educational phenomena, providing insights into student performance, learning outcomes, and the efficacy of teaching methodologies (Blitzstein & Hwang, 2019; Ross, 2020).

The relevance of probability distributions in educational research lies in their capacity to encapsulate uncertainty and variation within data. Researchers utilise these distributions to make informed decisions and predictions based on probabilities. For instance, in assessing student test scores, understanding the distribution of scores across a population helps educators identify the typical performance levels and calculate the probability of students achieving particular grades. Probability distributions also underpin inferential statistics, allowing researchers to conclude a larger population based on sample data (Jinming Zuo, 2021).

Several types of distributions commonly emerge in educational data analysis. The normal distribution shown in Figure 1 is prevalent in educational research due to its occurrence in naturally observed phenomena. This distribution is characterised by its unique properties,

such as the mean, median, and mode coinciding at the centre. This allows for a straightforward representation of variability and probabilities within a dataset. The binomial distribution is another significant type encountered in educational settings, mainly when dealing with discrete data or outcomes with two possibilities: pass or fail, success or failure in experiments, or responses to yes/no questions. Moreover, the Poisson distribution finds relevance in educational research when examining rare events or occurrences within a fixed interval, such as the frequency of student absences or rare academic achievements (Blitzstein & Hwang, 2019).

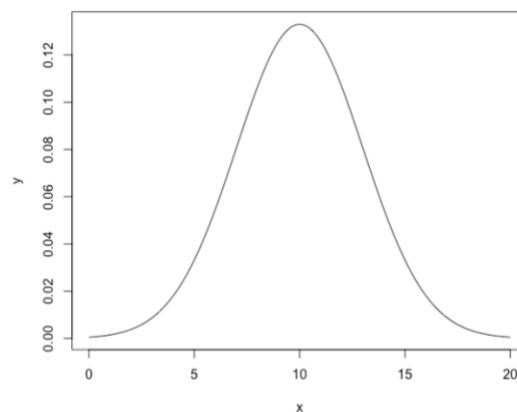


Figure 1: Normal distribution example visualised in R

Understanding these distributions equips researchers and educators with the tools to model, analyse, and derive meaningful insights from educational data. They form the basis for informed decision-making, enabling a more profound comprehension of student performance trends, the effectiveness of interventions, and the evaluation of educational policies and practices.

3 Fundamentals of Probability Distributions

The creation of the student's t-test marks a significant milestone in the history of statistics, attributed to the work of William Sealy Gosset, a British statistician who worked for the Guinness Brewery in Dublin, Ireland, in the early 20th century. Gosset faced challenges in analysing small sample sizes typically encountered in Guinness's quality control and brewing processes. The existing statistical methods of the time were unsuitable for small sample sizes. In 1908, Gosset introduced what would later be known as the student's t-distribution and the t-test in a paper published under the pseudonym "Student". Due to the constraints of secrecy imposed by Guinness, Gosset used this pen name to protect the company's proprietary information (Brown A.,2005).

The t-test was born from Gosset's need for a robust method to make inferences from small sample sizes. He derived a distribution based on the normal distribution but with heavier tails, suitable for smaller samples, to account for increased uncertainty. This distribution allowed

for calculating a statistic, now known as the t-statistic, used to test hypotheses about population means when the sample size is small and the population standard deviation is unknown. Gosset's pioneering work on the t-distribution and the t-test revolutionised statistical inference for small sample sizes, laying the foundation for modern inferential statistics and shaping how researchers analyse and draw conclusions from limited data in numerous fields, including the realm of educational research.

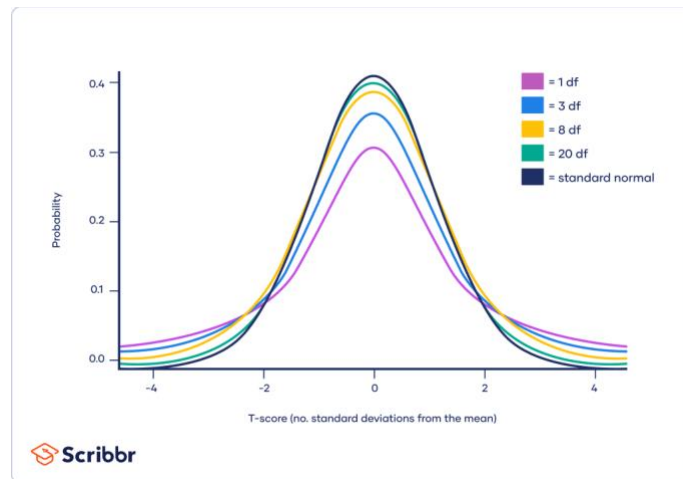


Figure 1: Comparison of standard normal and t-distribution (Bevans, 2020)

T-tests are fundamental statistical tools in pedagogical studies, playing a pivotal role in comparing groups and evaluating the effectiveness of educational interventions or methods. These tests assess whether observed differences between groups are statistically significant or simply due to random chance. Their significance lies in providing a structured framework for researchers to analyse and draw conclusions regarding the impact of teaching methods, interventions, or educational programs (J. et al., 2019; Rojewski et al., 2012).

In educational research, various types of t-tests are commonly employed. The independent samples t-test is prominent when comparing the means of two independent groups, such as assessing the performance of students taught through different teaching methodologies. Conversely, the paired samples t-test evaluates mean differences within the same group under different conditions or before and after interventions. This test helps study changes in student performance following an educational program. Both types of t-tests help researchers determine if observed differences in performance are statistically significant or if they could have occurred by chance (J. et al., 2010; Wright, 2006).

To illustrate, consider a study comparing the effectiveness of two teaching methods on student achievement. Researchers could use an independent samples t-test to analyse the test scores of students taught using Method A (for example, the flipped classroom method) versus Method B (classical education without flipped classroom). Similarly, in a scenario where an educational intervention aims to improve reading comprehension, a paired samples t-test could assess whether there is a significant difference in students' pre- and post-intervention

reading scores. These examples demonstrate how t-tests enable researchers to quantify and validate the impact of educational methods, providing empirical evidence to support educational decision-making.

Even with small datasets, calculating t-tests manually has become outdated. Fortunately, the availability of free tools like R has simplified this process, allowing us to perform these calculations swiftly and accurately.

4 Fundamentals of Probability Distributions

The “R” language stands as a versatile and powerful tool in statistical analysis, renowned for its extensive range of statistical capabilities and open-source nature. It offers a comprehensive suite of functions and packages tailored explicitly for statistical computing, making it a preferred choice in educational research for conducting complex analyses efficiently (Barnwal, 2017; Bretz et al., 2016).

One of the critical benefits of R in educational research lies in its ability to handle diverse statistical methods and techniques. Its extensive collection of packages supports various statistical analyses, including regression modelling, hypothesis testing, factor analysis, and data visualisation. This flexibility allows educational researchers to perform intricate analyses without the constraints often found in other statistical software (Barnwal, 2017; Field et al., 2012).

In educational research, R finds practical applications in various scenarios. For instance, researchers might use R to conduct regression analyses to assess the relationship between student performance and multiple factors like teaching methods, socioeconomic status, or classroom environment. The language's visualisation capabilities also shine when illustrating trends or patterns in educational data, aiding in creating insightful graphs or charts for presentations and publications. Furthermore, R facilitates reproducibility in research by providing a transparent and documented workflow, enhancing the credibility and replicability of studies conducted in the field of education (Pšenák et al., 2018).

The accessibility of R, coupled with its vast statistical functionalities, empowers researchers in educational settings to conduct sophisticated analyses, explore intricate relationships within data, and derive nuanced insights. Its role in educational research extends beyond analysis; it fosters a culture of transparency, rigor, and innovation within the academic sphere. Getting started with R is incredibly straightforward. You can freely download it from the R website, and we highly recommend coupling it with R-Studio, also available for free. Once installed, a plethora of free tutorials on platforms like YouTube and other online resources await. These abundant educational materials offer a quick and easy way to learn R efficiently.

5 Systematic Approach to Applying Statistics in Pedagogical Research

Employing statistics systematically in pedagogical research involves a structured approach, integrating statistical tools like probability distributions, t-tests, and the R language methodically within research workflows. A crucial asset for any researcher is a structured workflow that guides the entire research process. We aim to offer a versatile workflow applicable to various educational research scenarios, simplifying the initiation phase for researchers.

A proposed step-by-step guide to the process would consist of the following steps:

1. Formulating Research Questions
2. Data Collection and Preparation
3. Application of Statistical Tools
4. Data Analysis and Interpretation
5. Validation and Reproducibility
6. Iterative Process and Refinement

Researchers can methodically navigate the complexities of pedagogical research by systematically integrating statistics, probability distributions, t-tests, and the R language into research workflows. Our proposed analysis method leverages the information provided in this publication to enhance research speed and relevance.

Consider a scenario in which we implement the above-written educational research steps: *Research Question Formulation*: A team of educators aims to investigate the correlation between student engagement levels and academic performance across different learning environments. They precisely define their research objectives by framing questions that delve into specific aspects of student engagement, such as the impact of interactive learning versus traditional lecture-based teaching on academic outcomes.

Data Collection and Preparation: The team collects data from various schools, ensuring meticulous collection of student engagement metrics (such as participation in class discussions, completion of assignments, etc.) and corresponding academic scores. They prepare the dataset, ensuring accuracy and completeness by validating and organising the gathered information.

Application of Statistical Tools: Leveraging statistical software like R, the team conducts comprehensive analyses, applying suitable statistical methods to explore the relationship between student engagement metrics and academic performance, for example, with regression analysis.

Data Analysis and Interpretation: They derive meaningful insights through statistical analysis, identifying patterns and relationships within the data. The team interprets their findings.

Validation and Reproducibility: To ensure the credibility of their findings, the researchers diligently document their statistical procedures, codes used for analysis, and any data transformations undertaken. This documentation ensures the replicability and transparency of their research methodology.

Iterative Process and Refinement: Engaging in an iterative process, the team continually refines their analysis, considering alternative statistical approaches to strengthen the robustness of their findings. This iterative refinement cycle helps enhance the reliability and depth of their research outcomes.

6 Conclusion

In educational research, statistical analysis is an indispensable cornerstone, evident across data collection, analysis, and interpretation. This paper has journeyed through the multifaceted landscape of statistical methodologies and their pivotal significance within educational contexts.

Delving deeper, the exploration of t-tests explains their profound relevance in comparing groups within educational research scenarios. Some theoretical examples showcased their application. Integrating the R language helps improve the research experience, empowering researchers to conduct sophisticated analyses efficiently. Its capability as a statistical computing tool resonated across practical examples, underscoring its role in enhancing analytical prowess and expediting complex analyses within educational research.

Lastly, the systematic approach delineated herein provides a structured methodology for researchers to employ statistics effectively in educational research. This methodological framework emphasises open-source tools, offering a guide for navigating the intricacies of educational research workflows.

In conclusion, this paper encompassed various statistical probabilities, explored the historical context of the t-test, delved into the application of R, and introduced a framework tailored to educational research. Using freely available software tools was proposed to augment research efficiency and transparency.

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Criteria for Evaluating the Quality of Interactive Didactic Materials

Ildikó Pšenáková¹, Peter Pšenák²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1257>

Abstract

Interactive teaching materials and didactic applications are widely used in educational activities from primary schools to universities and higher educational institutions. Unfortunately, the quality of these materials does not always match the requirements they should meet. But the question is, what are those requirements? What are the criteria that will ensure the quality of the materials? The article contains proposals of possible criteria for examining and evaluating the quality of interactive educational materials. The overall assessment of the quality of a didactic application or learning material is created based on the evaluation of three key criteria: content structuring, design efficiency and evaluation system.

Keywords: Didactic, Interactive materials, Quality, Criteria

1 Introduction

In our modern era, the couch and television reign as the household favourites, while our mobile phones have seamlessly integrated into our handbags and pockets. Hours pass as we immerse ourselves in watching TV shows, scrolling through social media, and mobile gaming daily. In such a "digital" environment, it is challenging to engage our children in learning with the help of books and notebooks.

It becomes increasingly apparent that the field of education is embracing and implementing modern methodologies, facilitating its continuous evolution. A significant shift has occurred within the current educational landscape where computers, interactive whiteboards, and various information and communication technologies have assumed pivotal roles in the learning process. The gradual normalisation of students incorporating their smart devices as essential tools into education is underway (BYOD – Bring Your Own Device).

¹ Trnavská univerzita v Trnave, Pedagogická fakulta, Priemysel'ná 4, P. O. BOX 9, 918 43 Trnava.

E-mail: ildiko.psenakova@truni.sk

² Univerzita Komenského v Bratislave, Fakulta managementu, Odbojárov 10, P. O. BOX 95, 820 05 Bratislava 25

Numerous studies (Bakonyi, Illés, 2018) show that utilising these tools enhances learning efficacy compared to sole reliance on teacher-led instruction. Enhancing communication and collaboration between students and educators is attainable through utilisation of interactive teaching materials. These resources serve to boost learning motivation, amplify instructional clarity, foster subject comprehension, and infuse engaging elements into different lesson phases. In distance education, incorporating digital teaching materials has become indispensable, forming an integral part of the educational experience.

However, the preparation and utilization of digital teaching materials and their interactive application pose a formidable challenge. Often, it falls upon the teachers themselves to create suitable educational content, select elements of the “non-interactive” materials which are suitable for transformation into an interactive format, and select the data quantity incorporated within them. Crafting a design that not only supports comprehension and clarity but also distinguishes the interactive material from a mere electronic rendition of the textbook is no small feat.

In the early era of creating didactic materials, they were essentially digitalized workbooks. Subsequently, dedicated applications emerged, designed explicitly for pedagogical use. These applications have been instrumental in aiding classroom instruction and facilitating independent study for students. Furthermore, comprehensive software ecosystems have surfaced, empowering educators and enthusiasts to fashion their own didactic interactive materials and applications to their specific requirements. Yet, a crucial aspect in their creation lies in the thorough understanding and adherence to the principles governing the proper development of interactive didactic materials.

The amount of currently accessible didactic applications is notably varied, often lacking uniformity in their functionalities, which complicates the assessment of their educational value. To construct a well-rounded assessment, establishing principles, guidelines, or criteria becomes essential. These benchmarks would serve as a foundational basis to evaluate didactic materials systematically, enabling educators to discern and select the most fitting ones to meet their teaching requirements.

2 Interactive Didactic Material

Whether termed interactive learning material, educational material, or interactive applications, the nomenclature doesn't alter the core objective of the curriculum—presenting content for interactive student engagement, be it through interactive whiteboards or directly on computers. The fundamental essence remains consistent: it must encompass a comprehensive dataset tailored for interactive teaching methods, comprising two integral components:

- *static*, which is basically the same as the content of printed textbooks intended for teaching, possibly supplementing it with new knowledge, bringing additional images, and enabling effective work with text, images, and other components.

- *dynamic*, which is made up of interactive, multimedia elements incorporated into the curriculum. These can be animations, video clips, or audio recordings that cannot be presented in printed form. In addition, it may also include links to web pages that can be launched from the whiteboard through computer interaction. The teacher can also use his own materials, which are suitable for clarifying and diversifying the subject matter. (Pšenáková, 2019)

There are numerous options for introducing interactive elements into teaching materials. While some methods demand proficiency in programming languages, there are user-friendly software packages enabling the creation of interactive learning materials without coding expertise. These program environments empower educators—regardless of their computer science proficiency—to craft suitable interactive content. Competence in utilizing computer technology and specialized programs tailored for material creation suffices for their development (Pšenáková, 1998, 2001). Examples of program environments conducive to creating interactive teaching materials encompass, for example, HotPotatoes, Learning Apps, and Alf.

Regardless of the chosen form for creating didactic interactive materials, it's imperative for the teacher to grasp the fundamental principles of their proper creation and strive to adhere to these principles as closely as possible.

3 Principles of Correct Creation of Interactive Didactic Materials

Crafting teaching materials in the right way, whether interactive or not, involves a multifaceted process. Teachers possess the capacity to create interactive learning resources themselves, adhering to specific rules, language, and principles inherent to this creation. These guidelines and insights aim to render the material understandable, purposeful, intriguing, and frequently utilized. The advantage of crafting personalized materials lies in tailoring them to meet teachers' specific requirements, while aligning with methodological content. However, developing interactive educational materials demands advanced digital prowess alongside patience, creativity, and, notably, a substantial time commitment.

Individual preferences heavily influence the creative process. What one person finds aesthetically pleasing might not resonate similarly with another. Colours, for instance, evoke diverse reactions among individuals, and the arrangement of shapes and their abundance on the screen is inherently tied to the creator's taste. Even the size and style of the font can either enhance or hinder the readability and, subsequently, the comprehensibility of the text content. Ultimately, the completed didactic material is consumed by diverse students, each with their own unique tastes, diverging from those of the creators. Consequently, the overall impact of the curriculum hinges on numerous factors, whose interplay may yield positive or negative outcomes in different scenarios (Pšenáková, 2019).

The creator faces the dual task of aligning with the curriculum's content while also prioritizing the design aspect, given that teaching materials are predominantly presented via interactive whiteboards or computer screens. Prior to commencing the production of the learning material's visual elements, meticulous consideration is necessary regarding how to effectively integrate the required curriculum and information into a coherent and apt structure.

While crafting educational material, meticulous attention must be paid to its correct design, ensuring alignment with professional, didactic, and design standards while fostering comprehensive student development. True interactivity in the educational material necessitates activities capable of engaging all students in the learning process, ideally incorporating not just verbal and cognitive aspects but also prompting physical involvement to enhance the overall learning experience.

In the development of interactive educational content, the intended purpose of the material stands as the foremost guiding factor. However, it must also align harmoniously with didactic, technical, aesthetic, and economic considerations. Material devoid of clear objectives tends to lack organization and coherence, often straying from its intended focus. Conversely, planning tasks and objectives gradually brings clarity, especially when multiple authors collaborate simultaneously on its creation (Pšenáková, 2010a).

The author must be concerned with the content aspect only after defining the goals of the materials, when the creator starts looking for suitable sources of information - methodological instructions, literature, suitable websites, or other media. Only the necessary parts are selected from the sources, which together create a certain thematic whole. The selected information must not appear sketchy, because after the transfer of the teaching material, the issue will become even more visible. Language and its use also fall into the sphere of content, as it is inappropriate to use slang words, profanity, or diminutives (Pšenáková, 2019).

Once the objectives and content are established, the phase of preparing and structuring the teaching material commences. An essential consideration during this planning phase involves determining how to segment the content across individual screens (or interactive whiteboard pages), directly influencing how the material's content is perceived. Planning the structure is an ongoing process; the creator must envision future expansions and adaptations, considering the frequent renewal of information, common in education due to ongoing research and the inclusion of new topics.

The teaching material should not remain static; instead, it ought to evolve in tandem with the changing educational landscape. Should the curriculum become outdated or fail to meet students' needs, the teacher should modify and update the material accordingly. Priority should be placed on the visual appeal, quality of presentation, clarity, and the depth of knowledge encapsulated in the didactic materials. Creators must acknowledge that when teaching material is displayed via an interactive whiteboard, it becomes the focal point of the lesson. However, it should not unduly constrain the flow of the lesson or disrupt its natural progression.

The principles of the correct creation of interactive learning materials are elaborated in more detail in several publications (Pšenáková, 1998; 2001; 2007, 2010, 2010a; 2019; 2021), and we have given only a brief overview of this much more complex issue.

Drawing from the cited data, existing literature, and substantial personal experience, it becomes evident that the quality of interactive learning materials hinges on numerous factors that warrant careful consideration. While many authors endeavour to adhere to these quality standards, some remain unaware or unconcerned with them. Consequently, in practice, a significant number of educational materials surfaces, some of which prove unsuitable or only partially adequate for effective integration into the pedagogical process.

4 Theory of Transaction Distance

As electronic learning material and interactive applications are suitable for the implementation of distance education, when analysing didactic applications, we consider it appropriate to analyse and evaluate them in terms of transactional distance theory. Transactional distance theory is an educational framework that delineates pivotal concepts within distance education. It encapsulates a definition of distance education that emphasises the physical and/or psychological separation between teachers and students as a fundamental characteristic.

Michael G. Moore, a distinguished educator at Pennsylvania State University, crafted the transactional distance theory during the 1970s. In 1972, he published the initial articulation of this theory, positing that distance education is not solely about the geographic distance between students and teachers; rather, it fundamentally revolves around pedagogical principles (Moore, 1972). The theory contends that the physical and temporal separation between learners and instructors creates pedagogical challenges. To mitigate potential misunderstandings, effective course structures and active learner-teacher interactions are crucial in minimising these gaps and fostering effective education.

The theory of transactional distances asserts that decisions made by the creator of a distance course, typically a teacher, result in a specific structure, dialogue, and student autonomy. This balance is created either unintentionally during the instructional design process or as a deliberate choice in instructional design. Despite this, these elements interact, forming a transactional distance—a psychological and communicative space representing a potential misunderstanding between the teacher's input and the learner's input that needs to be bridged.

This theory's utility lies in guiding creators, instructors, and designers in course design by determining the optimal level of structure, dialogue, and autonomy. This balance aims to minimize transactional distances and, consequently, enhance learning outcomes. Transactional distance is defined as the dynamic interaction between teachers and students in environments characterized by spatial separation (Moore, 2007).

Transactional distance serves as a metric reflecting a student's challenge in actively participating within their online learning setting. This distance manifests across several dimensions: the separation between students themselves, between students and teachers, between students and the course content, and between students and the instructional technology employed (Zhang, 2003). Each of these facets contributes to the varying degrees of psychological and communicative space that can potentially hinder effective engagement within the learning environment.

Three interrelated factors need to be considered in the nature of the transaction between distance learning teachers and students (Moore, 2007):

1. Structure of the Program: encompasses elements defining the intended learning structure within the curriculum plans of the distance education program.
2. Dialogue Exchanged Between Teacher and Student (Teacher Interaction): Reflects the quality and nature of communication between teachers and students.
3. Autonomy of Students: pertains to the students' roles in decision-making regarding what, how, and to what extent they engage in the learning process, aligning with their roles in the proposed structure.

These three factors were derived from the analysis:

- curriculum plans of the distance education program (1)
- communication between teachers and students (2)
- students' roles in deciding what, how and how much to learn (3).

The nature of the course structure is characterized by its degree of rigidity or flexibility. This aspect encompasses various elements, including the extent to which the course's goals and objectives are pre-established, the chosen pedagogical model (like teacher-centred or student-centred approaches), the evaluation methods employed within the course, and the course's adaptability to cater to individual student needs. These components collectively delineate the structural framework of the course, dictating its adaptability, responsiveness, and alignment with diverse learning styles and requirements.

Dialogue extends beyond mere two-way communication; it encompasses all forms of interaction aligned with clearly outlined educational objectives. It embodies cooperation and mutual comprehension between the teacher and students, culminating in the resolution of learners' issues. Within this context, the emphasis lies not on the frequency of dialogue, but rather on its quality, depth, and efficacy in addressing the learning challenges encountered by distance learners. The focus remains on fostering an effective exchange that actively resolves and supports learners in navigating their educational obstacles.

Student autonomy is conditioned by the previous two factors, as it refers to the sense of independence and interdependence that students perceive when participating in classes. The nature of the dialogue shapes the extent to which students feel empowered to self-direct their

learning journey exchanged and the adaptability of the course structure, ultimately impacting their autonomy and agency in the learning process.

Moore's theory of transactional distances highlights the dynamic interplay between structure and dialogue. An increase in structure corresponds to an increase in transactional distance, while heightened dialogue correlates with a decrease in transactional distance. The complexity heightens with the inclusion of learner autonomy, where the distinction between personal autonomy and autonomy linked to learning materials remains ambiguous. However, the theory posits that as transactional distance expands, student autonomy also increases. This underscores the intricate relationship between these elements, showcasing their influence on the learning experience within distance education frameworks.

4.1 Types of Didactic Applications

The Park's categorisation was adopted (Park, 2011) concerning m-learning, which offers a foundational framework for our specific objectives. Considering the inclusion of teaching via mobile phones and online/offline education utilising personal computers under the umbrella of distance education, we infer that the requisites for interactive educational material should align for both scenarios. The outlined learning approaches exhibit diverse transactional and social dynamics within didactic applications; the didactic application can be characterised as:

1. *Highly Transactional and Socialized (TS)*- Emphasizes increased interaction between students and the teacher and encourages collaborative group work among students, with the primary interaction occurring among peers. Learning materials are disseminated via a didactic application, facilitating communication and engagement.
2. *Highly Transactional and Individualized (TI)*- Offers ample space for student-teacher communication. The application provides learning materials, focusing on individualised approaches to content processing. Students work autonomously with the provided curriculum. This approach showcases the advantages and flexibility of e-learning, enabling students from geographically disadvantaged areas to participate.
3. *Low Transactional and Socialized (LS)* - Promotes student interaction with both peers and the teacher, offering limited information to encourage group engagement, brainstorming, and greater social and technological flexibility in task development. The curriculum's endpoint remains open-ended, fostering asynchronous learning and prioritising peer-to-peer interaction.
4. *Low Transactional and Individualized (LI)*- is based on independent student work with minimal teacher influence. Teacher or application developer-led activities guide the learning process within this approach.

These approaches showcase a spectrum of transactional levels and socialisation, offering varied opportunities for communication, collaboration, and individualised learning within e-learning.

4.2 Classification of Didactic Applications Based on the Theory of Transaction Distance

When evaluating a didactic application, it is beneficial to classify it based on the transactional distance theory. This classification does not inherently influence the overall evaluation; instead, it serves as an informative criterion aiding in selecting the most suitable didactic application for a specific educational environment.

Didactic applications are attributed to:

- TS, if they require the cooperation of pupils and the materials are obtained through a didactic application,
- LS if it focuses on the cooperation of students, using the application primarily to guide the work,
- TI, if the application gives the material to the student but supports independent work,
- LI, if the didactic application is only intended to provide the student with guidance for independent work.

5 System of Criteria for Evaluating the Quality of Interactive Didactic Material

The development of digital educational resources occurs across diverse program environments, often lacking standardized procedures or guidelines for quality control. Authors frequently overlook design principles or opt for content unfit for electronic adaptation. Furthermore, these materials commonly undergo inadequate testing by students or a quality assessment process before implementation.

But the question arises, how to evaluate the quality of these materials? Are there evaluation criteria that would help determine whether the given material is suitable or unsuitable for use in the educational process?

Marciniak and Rivera (2021) created a system of indicators for the quality assessment of didactic materials in online education, consisting of 43 evaluation indicators. Based on these indicators, it is possible to evaluate didactic materials in detail, but the evaluation process is very long. For the needs of our project, we wanted to create a system of criteria based on which the evaluation of materials would be more straightforward.

Considering the points, we have established the following criteria for assessing didactic materials and applications:

- content structuring,
- design efficiency,
- method (system) of assessment.

5.1 Structuring the Content of the Didactic Application

Several educational applications make the mistake of overcrowding screens with excessive information, disregarding the reader's experience. This approach renders the digital application akin to an e-book, which might feature basic comprehension questions but fails to leverage the full potential of its digital medium.

Establishing precise educational objectives aligning with the curriculum and standards is crucial when developing a didactic application. Failing to do so constitutes a significant mistake. Without clear goals, content organisation on individual pages or screens becomes complicated, often leading to deviations from the main topic—especially evident in collaborative projects involving multiple creators. Besides defining primary goals, setting incremental sub-goals aids creators in gradually reaching a successful outcome. A practical didactic application should dynamically adjust its objectives based on user knowledge. Monitoring subject choice, content coherence, appropriateness for specific age groups, and language within the content page is advisable.

When assessing content structuring, it is essential to consider the data the application demands from its users. Every didactic application necessitates a user account to allocate this data while crafting a customised curriculum for students. Evaluating this criterion involves scrutinising how user information is handled, the extent of information required for account setup, the level of student involvement, and the data storage protocols. This scrutiny is crucial for detecting potential data misuse, like identity theft, and ensuring the application maintains the requisite user data security standards.

5.2 Effectiveness of the Design of the Didactic Application

Effectiveness in design encompasses all graphical elements within a didactic application. Such a tool demands simplicity, clarity, comprehensibility, and a user-friendly interface. A well-designed didactic application should instantly convey its intended goal. A common pitfall for novice designers is crafting an overly intricate system that impedes effective learning despite offering numerous user options due to its complexity and lack of clarity.

When developing interactive applications, adhering to critical principles significantly impacts their quality. Designing didactic applications warrants attention to three crucial subcategories of design effectiveness: colour, font, and graphics. Adherence to critical design principles heavily influences the quality of interactive applications.

Colours influence individuals, evoking diverse emotions. Colour accessibility is crucial to ensure the application is user-friendly for individuals with visual impairments. A well-thought-out colour scheme enhances readability and inclusivity. An illegible font within a didactic application can markedly diminish its effectiveness and create an unpleasant user experience. Additionally, graphic design is pivotal in influencing material visibility, whether enhancing or detracting

5.3 Evaluation System of Didactic Application

The evaluation system within didactic applications holds significant importance. Unfortunately, numerous learning management systems (LMS) and didactic applications lack provisions for learners to rectify errors or address deficiencies. Upon completing a learning unit, it is beneficial to grant students the chance to revisit past exercises or assignments to identify their mistakes. Simply offering a percentage score and a choice to proceed or repeat the task is inadequate. A practical didactic application should actively assist users in error correction. Moreover, enabling adjustments to task difficulty, such as providing additional information after an incorrect answer, proves advantageous for users' learning experiences.

6 Evaluation of the Quality of Interactive Didactic Material

In crafting evaluation criteria for didactic applications, using transactional distance theory aids in classifying these applications into four distinct types. However, this classification does not directly impact the comprehensive evaluation; it is an informative tool for selecting the most suitable didactic application for a specific educational setting. Following this classification, educators need not assess applications unsuitable for their current environment, streamlining the selection process for the appropriate educational tools.

In our assessment of didactic materials, we identified key elements aligned with the primary criteria outlined earlier (content structuring, design efficiency, and evaluation system). We have formulated a table enumerating our proposed criteria to streamline this assessment process. Evaluators can allocate points to these criteria (Table 1). This table is available for manual printing and completion. Additionally, we have developed a version compatible with MS Excel, facilitating the automatic calculation of scores based on the assigned points for each criterion.

Filling in the table is very simple. The name of the material to be evaluated is entered in the first line. The application type can be indicated within the print version by marking a cross within the respective square. Conversely, the electronic version features a dropdown list (combo box) for selection. Upon opening, this list presents four possible types based on transaction distance theory (TS et al., LI). It is important to note that classifying an application into a specific type serves an informative purpose. This classification doesn't categorise a didactic application as inherently good or bad; each type serves a distinct didactic scenario based on its characteristics and suitability.

The next part of the table is divided into three sections according to key criteria, which collectively create an overall assessment of the didactic material. In the individual sections, we have singled out several characteristics according to which the quality of the didactic application is evaluated:

1. structuring of content: purpose of the application, selection of subject matter, suitability of the topic, active participation, data security,

2. design efficiency: colour scheme, typography, graphics, images, animations, videos, user environment,
3. evaluation system: accessibility of topics, active error correction, difficulty adjustment.

Table 1: Evaluation table of the didactic application

Application name:	
-------------------	--

Mark with a cross!

Application type:		Highly Transactional and Socialized (TS)
		Highly Transactional and Individualized (TI)
		Low Transactional and Individualized (LS)
		Low Transactional and Individualized (LI)

Enter points from 0 to 5!

Content structuring	Rating		Notes
Purpose of the application			
Selection of subject matter			
Suitability of the topic			
Active participation			
Data security			
Category rating	<i>Mean =</i>		

Design efficiency	Rating		Notes
Colour scheme			
Typography			
Graphics, images			
Animations, videos			
User environment			
Category rating	<i>Mean =</i>		

Rating system	Rating		Notes
Accessibility of topics			
Active error correction			
Adjustment of difficulty			
Category rating	<i>Mean =</i>		

Insert calculated averages!

Overall rating	Category rating		Notes
Content structuring			
Design efficiency			
Rating system			
Evaluation result	<i>Mean =</i>		

Each characteristic is assessed on a scale of 0 to 5, with 5 indicating the highest rating. The evaluation of the main category is derived from the average rating of its attributes. When filling out a paper form, the evaluator manually computes this average, whereas in the

electronic version, this calculation is automated. In the "Remarks" section, the evaluator can provide a concise rationale for the assessment.

Subsequently, after evaluating each key category, the computed partial averages are entered (manually or automatically) in the lower section titled "Overall Evaluation." The cumulative average of these partial averages determines the final evaluation outcome.

7 Conclusion

Back in 2001, Marc Prensky categorised individuals into two distinct groups: the "Digital Natives," who were born into the realm of advanced information and communication technologies like computers, video games, and the Internet, and the "Digital Immigrants," representing the generation for whom these technologies became integrated into their lives. This latter group had to familiarise themselves with them, learn, and adapt to the digital landscape (Prensky, 2001).

Digital natives are surrounded by modern technology from an early age, practically from birth, and an environment full of technology is a natural, self-evident part of their lives. These children and young people do not even realise that a few years before birth, there was no Internet or mobile phones. They have already grown up among different media practically from the cradle, so their way of thinking and working with information differs from the way of thinking and working of digital immigrants. Prensky claims that digital natives absorb new information quickly, can multitask, prefer graphics to text, like random information (e.g., hypertext), prefer play to "serious work", and so on. The theory calls those who were not born into the digital world, but at a particular stage of their lives had to adopt the culture of new media, digital immigrants.

Nonetheless, the evolution of technology and the natural progression of generations signify that the immigrant generation will gradually phase out, leaving behind only natives who seamlessly integrate electronic media into their lives. While this shift poses certain risks, electronic media will remain a vital source of information, education, entertainment, and relaxation for future generations. Educators must recognise the transition from traditional curriculum-focused schooling to a modern learner-centric approach to drive educational advancement. Traditional schooling prioritises teachers' dissemination of information, whereas modern education centres on student activity and skill acquisition. A modern educator does not just fulfil responsibilities but pioneer's new ideas and imparts them. Interactive teaching epitomises a contemporary, potent instructional technique grounded in pedagogical interaction. Integrating interactive elements into electronic teaching materials enriches the educational experience, rendering the curriculum more engaging and comprehensible for students, accelerating learning, and augmenting academic performance. Furthermore, leveraging information and communication tools, including interactive whiteboards, positively influences the development of digital competencies among students due to heightened engagement, thereby enhancing their academic outcomes.

Crafting didactic, interactive materials and applications requires a multifaceted skill set. It goes beyond mere design proficiency; it necessitates a command of web design and typography, comprehension of how program code influences system functionality, and a deep understanding of pedagogical principles applicable to traditional and distance learning settings. Didactic applications augment students' learning within school premises and extend learning opportunities beyond, enabling access for individuals facing medical or other limitations. Consequently, these applications must adhere to specific criteria serving as benchmarks for evaluating their quality.

The suggested system for evaluating didactic applications is among many approaches to assess their quality. It is a subjective methodology that allows for agreement or disagreement. Given our lack of prior experience with such a system, it is a valuable tool aiding in selecting suitable applications for practical use.

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Electrical Engineering and its Aspects in the Modern Concept of Technical Education

*Cestmir Serafin*¹

DOI: <https://doi.org/10.53349/resource.2024.is1.a1258>

Abstract

This paper focuses on some aspects in the concept of teaching electrical engineering in technical education. It is presented the issues of possible approaches and tools allowing to implement the teaching of electrical engineering in a demonstrative and entertaining way using contemporary means based on digital technologies. In this framework, the possibilities of motivating students are also presented and some findings from selected scientific papers, domestic and foreign research are also summarized.

The introductory part presents the issues related to the definition of subject or subject didactics of electrical engineering as a prerequisite for successful teaching by teachers. The next part is devoted to a research investigation focused on the application of new approaches to teaching electrical engineering in school practice, the possibility of linking virtual or augmented reality in a demonstrative approach to teaching, the use of online applications to solve electrical engineering problems and thus linking the practical form of electrical engineering with the theory presented in the classroom with the support of digital technologies.

The conclusion then summarizes the possibilities associated with the teaching of electrical engineering and the search for new paths that are common to both students preparing for the teaching profession and the students who will one day be guided by these teachers through the secrets of electrical engineering as one of the most important fields of human activity.

Keywords: Educational research, Subject didactics, Educational process, Teaching management, Electrical engineering, Digitalization, Virtual reality

1 Introduction

The lightning that crosses the sky during a thunderstorm is one of the most visible manifestations of electricity. In almost all other cases, electricity is invisible, yet it serves us tirelessly. Electricity powers machines, controls instruments, and provides light and heat. The signals that make telephones, radios, televisions and computers, are also of electrical

¹ Faculty of Education, Palacky University in Olomouc, Zizka sq. n 5, 779 00 Olomouc, Czech Republic.
E-mail: cestmir.serafin@upol.cz

origin. However, how do we bring this world closer to people who encounter the manifestations of electricity on a daily basis but know little about its nature? How to explain these phenomena? Dry theory, which is most often encountered in physics textbooks and electrical engineering publications (Mayer, 1981); (Cook, 2004), usually does not tell us much. However, what about practically "touching" electricity, testing the theory in a different, more fun way (Serafín, 2018); (Serafín, 2023)? After all, what sticks best in the mind is what everyone tries out and personally verifies (Baylor & Ritchie, 2002).

From the school's perspective, the abstract nature of the field of electrical engineering places demands precisely on the design of educational programmes, on the relevant chapters of textbooks and methodological manuals, but also on teaching aids (Stoffa & Šefara, 1999); (Thomas, 2016); (Sedlák & Štoll, 2002). Illustration plays a big role here. Introducing pupils to the basics of such a vast field as electrical engineering is not easy, especially if we bear in mind the short time currently allotted for this within the curriculum. The issue of didactic transformation is crucial in the teaching environment, as is the aforementioned demonstration. Of course, the teacher's approach is also indispensable, as discussed by David Heywood and Joan Parker in their book *The Pedagogy of Physical Science* (Heywood & Parker, 2012).

The issues of the concept of the curriculum, the approach to teaching, are connected with didactics, the theory of education, which deals with the forms, procedures and goals of teaching (Stuchlíková, Janík, Beneš, & et al. , 2015); (Janík, 2010); (Průcha, Walterová, & Mareš, 2013); (Serafín, 2023). In this context, we are talking about an educational process in which we introduce students to the secrets of electricity and the field of electrical engineering as a whole. As already mentioned here, part of this process is the question of the mediation of educational content, i.e. the selection of the curriculum and the specific didactic representation of the educational content by the teacher. However, the research in this area is rather fragmented, which, moreover, is confirmed by Marilyn Cochran-Smith and Ana Maria Villegas in their research report (Cochran-Smith & Villegas, 2014).

2 Concept of didactics of electrical engineering

If we want to conceptualize electrical engineering as a content of teaching, whether in the traditional sense or in an innovative way with elements of activating learning, we should first look at didactics from the perspective of the teacher's tool to conduct teaching.

Subject and subject didactics, along with general didactics, are among the pedagogical disciplines that describe and explain the processes of teaching and learning. General didactics establishes general patterns of teaching. If we focus general didactics on the teaching of specialised subjects, we move from the general position to the position of specific, i.e. subject or subject didactics (Stuchlíková, Janík, Beneš, & et al. , 2015); (Janík, 2010); (Průcha, Walterová, & Mareš, 2013); (Serafín, 2023). The relationship between didactics and the relevant discipline is multi-layered and dynamic, and can therefore take different forms, but it is always necessary to balance the conditions of student learning and

the disciplinary quality of teaching. The discipline of didactics is therefore a science that mediates the discipline towards the pupils².

Electrical engineering from the perspective of learning, didactics is the theory and practice of teaching and learning electrical subjects in relation to the education and formation of knowledge, skills, competences, attitudes and other dispositions and is therefore the sum of the didactics of individual electrical subjects, but is not the sum of these didactics. In general, terms the didactics of electrical engineering deals with:

- the subject of electrical engineering didactics,
- the history of the teaching of electrical engineering, and
- the educational significance of electrical engineering.

On a special level, the didactics of electrical engineering discusses:

- the content of the subject/field of electrical engineering and
- the means by which the main educational objectives of the subject/field of electrical engineering can be met.

If we characterize the didactics of electrical engineering subjects as a science, then the didactics of electrical engineering can be understood as an interdisciplinary, independent boundary discipline that didactically processes the knowledge of electrical engineering and integrates it with the knowledge of social sciences in the didactic system of electrical engineering subjects (Serafín, 2023).

2.1 Electrical engineering as a subject of teaching

The relationship between didactics and electrical engineering science is very close. First of all, because the didactic transformation of the curriculum and the subject-matter expert content are based on the science. When examining the relationship between didactics and electrical engineering, from which the subject of teaching (for example, electrical engineering) is based, it is necessary to realize that didactics does not examine the laws of a specialized science, but the laws of the process of teaching, and therefore the process of learning about electricity, electrical engineering (Serafín, 2023).

For the successful implementation of teaching, of course, the teacher must have knowledge from a wide range of scientific disciplines and not only electrical engineering. Electrical engineering is very closely related to mathematical and natural science disciplines, and has its place in many engineering and technical applications of other sciences, but in the context of education in non-technical fields such as sociology, logic and others. Incidentally, electrical engineering is also an aggregate of many scientific fields in itself, many of which nowadays form separate disciplines (e.g. electronics, mechatronics, etc.). In summary, therefore, it can be said that the multidisciplinary of education does not avoid the specificity of electrical engineering, as is the case for other disciplines or fields. Slavík, Janík et al. also discuss this in their monograph on transdisciplinary didactics (Slavík, Janík, Najvar, & Knecht, 2017).

² Note: not all content in the field is conveyed, but those that appear to be useful from a teaching and learning perspective i.e. contribute to the development of knowledge, skills, competences, attitudes and other dispositions of pupils/students at a particular level and type of school are selected.

The socio-cultural changes underpinned by the information explosion and technological developments at the turn of the millennium brought with them, among other things, a certain cluelessness in the field of education, precisely in the context of the notion of didactic transformation. The ever-new insights that are emerging in terms of technology and the shifting knowledge of humanity are placing the disciplinary and subject didactics under great pressure that has not yet been adequately mastered. There is thus no majority consensus on what the content of education should be and what methods and tools should be used to deliver it, which of course does not only apply to electrical engineering.

In the context of the increasing amount of information, there are significant changes in the conception of educational goals worldwide or innovations of the existing ones (Straková, 2013). In this context, there is talk of pedagogical constructivism, which has represented one of the dominant contemporary paradigms in didactics so far. The basic starting point is the learner constructing his/her knowledge on the basis of his/her own experiences. Many scientific publications have been written about constructivism as a theory of learning and much research has been carried out in which it has been shown that constructivist approaches can contribute to improving the state of learners' cognition and in the process of their learning in their understanding of basic knowledge and concepts (Naylor & Keogh, 1999), of which electrical engineering is full.

Although new approaches to science education have been developed just in the last few decades, thinking for example of inquiry-based learning (Dostál, 2015), scientific thinking continues to dominate mainstream school teaching, which is often dominated by fact-based teaching in the form of data and definitions. An unfortunate paradox of the current information and technology explosion is that the volume of almost ballast-like knowledge leads to information overload, resulting in further fragmentation and trivialization of knowledge and thinking.

3 New aspects in the concept of teaching electrical engineering in technical education

Electrical engineering is a concrete field with a content of laws that need to be known in order to reveal the essence of the field to the individual and to show even those areas that are hidden behind these laws to the ordinary observer. The question of experimentation, exploration, the search for creative solutions are tools to motivate in the process of learning, education. Moreover, in recent years they are supported by the development of digital literacy as one of the literacies needed for life in the 21st century.

The approach to the teaching of electrical engineering, as already mentioned here, requires a comprehensive concept combining the expertise of the "technician" and the pedagogical mastery of the "teacher". Curriculum design is then a very complex issue, which

involves the search for possible ways of integrating diverse knowledge in conjunction with the effectiveness of its transmission. A significant role is played here by the already mentioned project, experimental, creative and research approach in connection with the didactic transformation of the content of the field (Kropáč & Kropáčová, 2006).

In the teaching of electrical engineering, basic scientific knowledge is presented, which teachers convey to pupils in such a form that pupils not only remember it, but also understand it and are able to work with it further. This approach is based on the re-shaping of educational content in the form of reducing the amount of scientific knowledge and returning it to a form in which this content is relatively easy for pupils to understand and is supported by project, experimental or even research activities in electrical engineering. In his work, Knecht (2007) proposed the so-called ideal model based on the development of concepts of didactic mediation of educational content with the definition of the roles of the different actors influencing the creation of educational content. This model illustrates a process that can be fully associated with electrical engineering (see Figure 1).

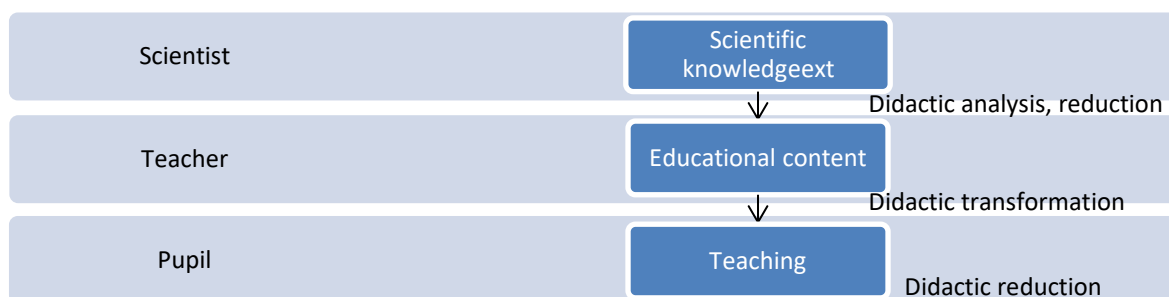


Fig. 1 Mediation of educational content (Source: Knecht, 2007).

3.1 Interactive learning in the context of electrical engineering

Interactive and multimedia teaching are nowadays concepts very well anchored in pedagogical theory and practice. One of its aims is to make today's teaching process more attractive and effective and to offer students new opportunities to actively engage in the acquisition of applicable knowledge and skills. The technological environment in which they are growing up offers many tools previously unthinkable in education and practice.

The development of technology, supported by the development of digital literacy, is leading us to view technology and technical literacy from a different angle than we have been used to, and today's generation is demonstrating this in their approach to learning and education in general. Demonstration is a fundamental prerequisite that will always guide us as teachers in the teacher-student relationship.

Hrabal & Pavelková (Hrabal & Pavelková, 2010) in research focused on the popularity and difficulty of subjects from the perspectives of students and from the perspective of teachers. On the other hand, which subjects teachers think are popular with pupils and which are not because of their difficulty. The authors conclude that science subjects are the unpopular

ones and are more difficult for pupils to master, whereas computer science appears to be the subject preferred by pupils. This statement, compared with the availability of ICT, leads to the conclusion that ICT-supported learning can be much more effective than previously assumed. This is also supported by the availability of these technologies in the home. Here, then, we can ask the question: Can the popularity of computer science and the availability of technological tools be used to support other, less popular educational subjects? And let us ask further: How can computer science be integrated into these subjects to make learning as effective as possible? One of the goals of the current changes in the Framework Educational Programmes in the Czech Republic is to integrate digital literacy into other areas of education, into educational subjects.

When we talk about interactive and multimedia teaching of electrical engineering, we associate this teaching mainly with interactive whiteboards. The interactive whiteboard, interactive and multimedia teaching model is now a frequently used model in modern teaching environments, provided that the appropriate multimedia textbooks or aids are available. Of course, working with a multimedia textbook using an interactive whiteboard is only one option. Significant in this matter are the various forms of animations, the use of videos and other multimedia where both students and teacher work in the same space connected by personal devices such as laptops, tablets or mobile phones.

Technology in general, and electrical engineering in particular, offers various possibilities for interactivity, which are just supported by contemporary technological possibilities. Here we can mention, of course, 3D modelling and the creation of animations and videos that can illustrate how certain devices are made or work. These videos, models and animations are very valuable tools in teaching because of their availability on the Internet for both students and teachers in teaching and self-study. At the same time, pupils can create them themselves in project-based learning under the guidance of the teacher, or the teacher can create them themselves. As an example, we present an application by students of the Department of Technical and Information Education of the Faculty of Education in Olomouc on the topic of electric motors (see Figure 2).

Another possibility of incorporating contemporary technologies designed primarily for entertainment is augmented or virtual reality. Especially augmented reality is one of the trends that have great potential for schools in the near future.

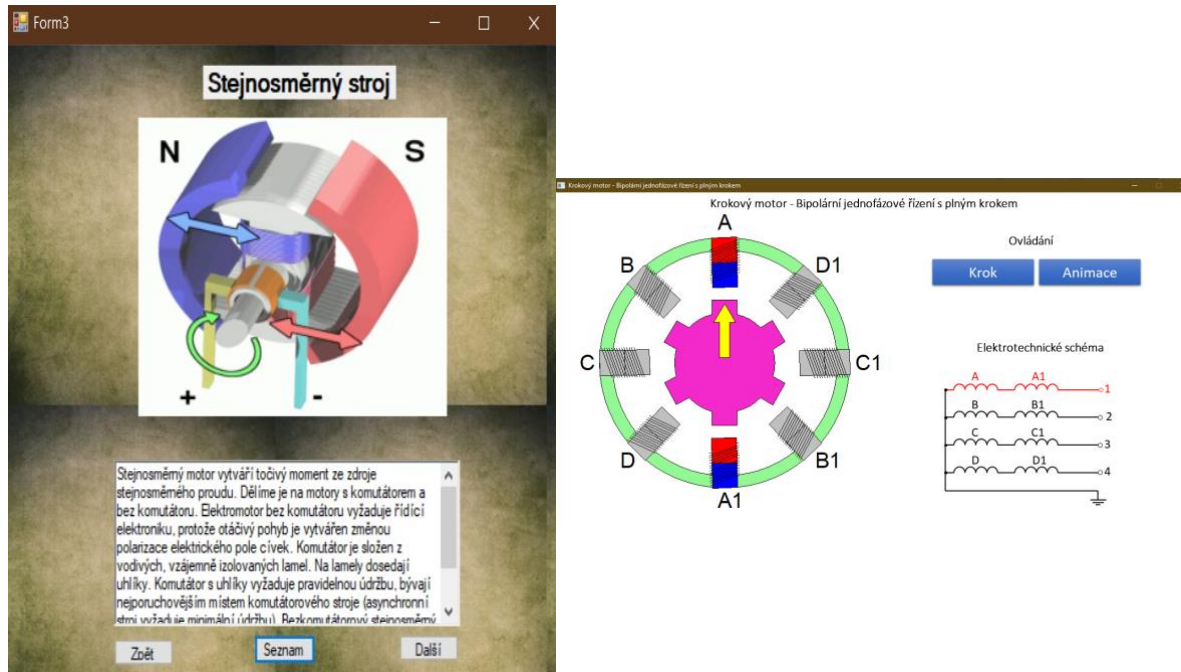


Fig. 2 Application on Electric Motors (Source: own processing)

According to Azuma (Azuma, 1997), augmented reality is only a part of virtual reality, although it allows the user to see the real world and the virtual elements placed in it in different layers. Other authors (Takemura, 1994) view augmented reality as a separate category of the technological and mobile industries, using some of the content used for virtual reality. The great advantage of augmented reality over virtual reality is that the device for displaying augmented reality can be smart mobile phones with a special application installed, tablets or laptops, but also special glasses (e.g. Google Glass, Epson Moverio BT-300) or helmets. However, the latter are already more expensive.



Fig. 3. Virtual switchboard with the real switchboard in the background (Source: <https://www.vseoprumsylu.cz/digitalizace/virtualni-rozsirena-realita/digitalni-rozvadec-primo-na-stole-eplan-eview-free-nyni-s-ar-funkcemi.html>)

The application of augmented reality in production practice is slowly becoming a common part of many companies. According to a survey conducted by the Association of Small and Medium Enterprises and Tradesmen of the Czech Republic, more than 30% of companies use virtualization technologies and more than 23% are considering using them.

Augmented reality makes it possible to create copies of real objects in a virtual environment and vice versa, to display virtual objects as if they were right in front of the observer. The basic idea is to map space using a camera. A mobile phone, tablet or goggles will get an idea of the environment they are in and then use 3D models and the appropriate software, a virtual production line or car can be seen, which can be virtually disassembled and examined for individual parts (see Figure 3) and a repair procedure can be designed for these.

The integration of virtualization tools into education has undoubtedly a future. Klement (Klement, 2020) states that "The use of virtualization technologies in education, or in school settings, is currently a relatively unexplored area. It is possible to find some works in the literature that deal with this issue in a partial way, but so far we are not aware of a review study that attempts to systematize the possibilities and ways of using this progressive technology in the conditions of the educational process".

3.2 On-line applications in electrical engineering

Simulation programs another of the tools that today open a wide field of possibilities for the analysis and simulation of processes in simple, but also very complex electrical circuits. However, their use in the teaching of electrical engineering has not been very frequent, even in university teaching. Electrical engineering is a discipline that is based on practical

experimentation and there is no reason not to use the possibilities of various software or online applications and virtual reality tools.

As a result of historical developments that began in the 1950s and thanks to the power of contemporary computers, mobile phones and tablets, programs designed to simulate electrical circuits are now the standard for many so-called virtual laboratory tools. SPICE has become the standard for analogue simulation, while several software tools have been developed for digital simulation. Simulators with the "Mixed-Mode" attribute are capable of simulating circuits at both analog and digital levels (Banks, 1998).

From a teaching perspective, the analysis of electrical circuits can be characterized as a concrete procedure from the circuit model to obtaining a numerical result. Currently existing analysis methods can be divided into non-algorithmic, or heuristic, and algorithmic methods (Biolek, *Výuka obecných metod analýzy lineárních obvodů*, 1994). The former can be classified as procedures that the solver chooses based on his/her current and previous experience, thus it is a constructivist approach. The algorithmic method, on the other hand, defines a precise procedure - an algorithm, for example, in solving a circuit using the loop current method. Each of these methods performs a function in the solution: the non-algorithmic method forces the solver to think creatively in a technical way, while the algorithmic method provides a tool for the solution. Both approaches can be suitably combined in teaching.

Model analysis has its own objectives, inputs and outputs, method, form and means of implementation. The form of the analysis is mainly determined by the means of its implementation, i.e. a computer with appropriate software. In addition to computational and technical objectives, the analysis may have other objectives, for example, the teacher may assign pedagogical objectives in the form of practicing a particular analysis method or understanding a particular process in a circuit. Among the basic pedagogical objectives in the context of electrical circuit analysis we can see:

- a) encouraging students to think creatively using the basic laws of electrical engineering (Ohm's law, Kirchhoff's laws) and principles (principle of superposition, equivalence, etc.). The analysis should contribute to a better understanding of the function of an electrical circuit. The pupil is thus actually exercising his "electrician's feeling" as to whether the distribution of voltages and currents is real or not, and how he can obtain further results from the partial results obtained so far;
- b) mastering an effective tool, i.e., the algorithmic method of analysis, to solve electrical circuits; and
- c) understanding the principles of circuit analysis methods implemented in commonly used simulation applications.

Computer simulation for the analysis of electrical circuits can nowadays be implemented using special software (typical representatives are TINA, MicroCap, Multisim, etc.) or using universal programs for mathematical and scientific calculations (MATLAB, MAPLE, etc.) (Biolek, 1999).

The advantages of using computer simulation in electrical engineering include:

1. the possibility to examine all parts of an electrical circuit without the need to incur the costs of its physical implementation. Also, the cost of eliminating the consequences of a bad decision is minimized by simulation;
2. it is often possible to incorporate changes in time and implement processes in an accelerated manner;

3. understanding of the causes of a given phenomenon in a real electrical circuit, which often cannot be explained except, for example, mathematically, but also those that cannot be captured in their entirety. The causes can thus be determined by examining in the process of reconstructing the events that took place in a given electrical circuit;
4. simulation can be used to solve, to design entirely new approaches, to implement new forms of electrical circuits and to simulate the consequences of these designs in real time;
5. simulation can be used to solve very complex systems that are not solvable or difficult to solve by analytical methods;
6. observation of the operation of the simulation model leads to a better understanding of the real electrical circuit.

On the other hand, the disadvantages of using simulation in electrical engineering include:

1. often the need for professional training to create simulations, especially in the use of relevant programs/applications;
2. the results of electrical circuit simulation can sometimes be interpreted only with great difficulty (random variables based on random inputs);
3. modelling and subsequent analysis can be time consuming;
4. electrical circuit simulation can be used inappropriately and sometimes not reflecting reality.

That an electrical circuit simulation may differ more or less from a real circuit is unfortunately a reality - the key is the inclusion or non-inclusion of all conditions and circumstances in the model that may affect the reality of the circuit. It is necessary not only to build the electrical circuit model, but also to include other conditions, i.e. to set the simulation parameters as accurately as possible. This circumstance depends on the capabilities of the program/application, what can and cannot be set.

Methods of analysis of electrical circuits should not only serve as tools for solving these circuits, but the teacher can also use their possibilities for explanatory purposes. However, it is necessary for the user to have at least a minimum theoretical background in order to use computer programs and applications for circuit simulation correctly, consisting of an understanding of concepts such as initial conditions, nonlinear and linear circuits, transient processes, steady state, etc. Thus, the approach to teaching in this concept has much different features from the classical laboratory teaching and combines different methods and procedures. Levert and Pierre (Levert & Pierre, 2000) offer a methodology - a general concept about modelling a virtual laboratory and using simulation models that should work in different configurations and on different platforms (Michael, 2001). Computer simulation, analysis of electrical circuits can be implemented in the school environment in two possible ways:

1. specialized software in the form of a computer program that the user installs on a computer, tablet or mobile phone or
2. online applications that allow simulations to be created directly on the Internet without the need to download the product to a computer.

Nowadays, one can encounter many programs and online applications that have different levels and usability both from the user's point of view and, above all, from the teacher's and student's point of view, i.e. from the point of view of the learning process in which they are or can be involved.

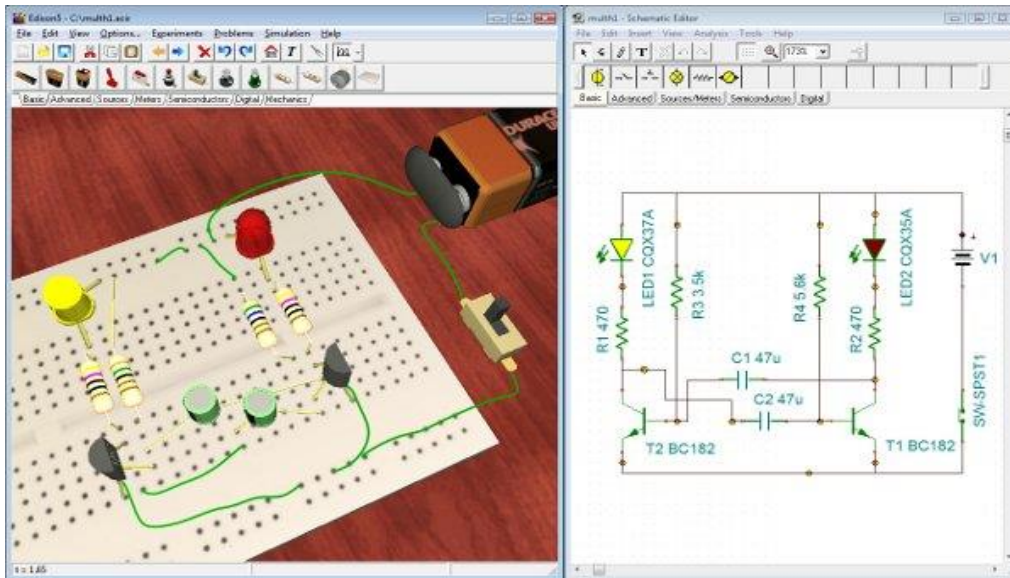


Fig. 4 Edison program (Source: own processing)

Figure 4 shows the Edison program from DesignSoft, which is based on the TINA platform. It is a program that needs to be installed on a computer. Edison can be considered as a good simulation tool that combines circuit diagram modelling with 3D visualisation of the individual components on the workbench. The program also offers experiments with problem problems and is distributed in Czech language.

Online simulation tools include Multisim Live (Figure 5), which allows the use of the same simulation technology as the Multisim program from National Instruments. The program provides an environment based on the SPICE standard. It includes analogue, digital and power electronics. In addition, the program allows the simulated circuits to be compared with real circuits, i.e. with real measurements in the Measurements Live environment using the NI ELVIS III oscilloscope. Due to the English-only version of the program, knowledge of professional English is also required.

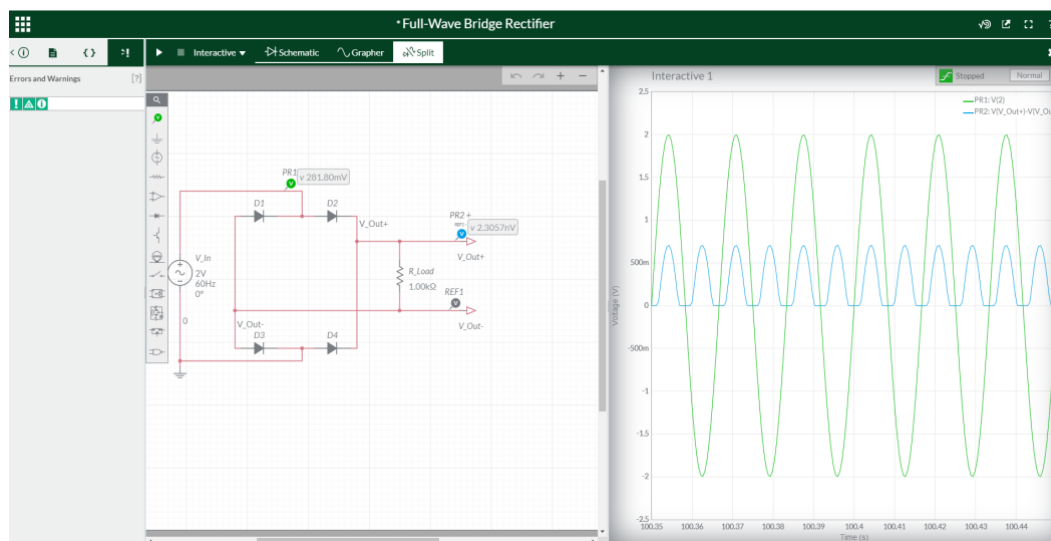


Fig. 5 Multisim Live application (Source: own processing)

4 Factors influencing the level of teachers' competences

For decades, many studies have found consistent results in terms of recognizing that teachers' competence in using digital technologies such as computers, mobile devices and the internet significantly influence their technical skills and other competencies towards modern technological tools for teaching leadership (Blotnicky, Franz-Odendaal, French, & et al., 2018); (Knecht, 2007). This was the reason for conducting a research investigation into the technical literacy of novice teachers in conjunction with digital literacy. The following research questions also informed the investigation:

1. What are the levels of technical and digital literacy with an emphasis on electrical engineering among beginning teachers?
2. What are the relationships between the variables of technological self-sufficiency, anxiety and uncertainty and the levels of technical and digital literacy with an emphasis on electrical engineering among pre-service teachers?

The research sample for this study was primary and secondary school teachers. A total of 360 teachers were interviewed in the study, of which 351 respondents' responses could be considered relevant to our study. The questionnaires included questions related to gender, number of years of teaching experience and questions dedicated to their technical competences in the field of electrical engineering, as well as digital competences related to the subject. These were graduates of teacher training courses with a focus on technical education, work activities, etc. Teachers, graduates of technical universities, were not contacted in this survey.

The first research question was measured by the mean of the respondents' answers with standard deviations. The second research question was analysed by correlation analysis of the relationship between self-confidence and anxiety and levels of technical competence with emphasis on electrical engineering. Subsequently, a t-test compared the level of competence between lower confidence/anxiety (below the mean) and higher confidence/anxiety (above the mean). This process allowed us to identify the factors influencing the level of technical competence in the selected sample of respondents by examining the relationships between the variables.

If we look at the means and standard deviations of the subgroups in the measurement of technical competence (see Table 1), we can interpret the results as showing that respondents differed the most in their answers, and therefore achieved the greatest variance in Networking or online communication about technology (mean 4. 57, variance 1. 38) and conversely, they achieved the lowest variance for Technical Skills in Electrical Engineering (mean 6. 25, variance 0. 85), with relatively low levels of variance in the categories of Technical Confidence in Electrical Engineering, Anxiety and Insecurity in relation to Electrical Engineering.

Category	Mean	Deviation
Technical skills in electrical engineering (TD)	6,25	0,85
Knowledge of the Internet world in relation to technology, information search, technical news (MGP)	5,59	1,29
Networking or online communication about technology (S)	4,57	1,38
Activity in technical creativity in relation to electrical engineering (AT)	2,46	1,23
Critical perspective on electrical engineering (KP)	3,72	1,19
Technical self-awareness in electrical engineering (TS)	5,44	0,93
Anxiety and uncertainty in relation to electrical engineering (UN)	3,06	0,86

Table 1. Averages and standard deviations of respondents' answers (Source: own elaboration)

The correlations between the two (Technical self-confidence in electrical engineering (TS) and Anxiety and uncertainty in relation to electrical engineering (UN)) and other groups (TD, MGP, S, AT and KP) are shown in Table 2. Pearson's correlation coefficient was chosen to determine these associations, which ranged from -0.28 to 0.66. There were then strong correlations between UN and S (0.53) as well as between UN and KP (0.54). It is also evident that TS is less strongly and negatively correlated with TD, MGP and S, but TS has no significant correlation with UN. In addition, no correlation was higher than 0.70.

	TD	MGP	S	AT	KP	TS	UN
TD	-	0,39	0,26	0,04	0,24	0,46	-0,28
MGP		-	0,33	0,21	0,45	0,47	-0,28
S			-	0,50	0,46	0,53	-0,17
AT				-	0,66	0,30	-0,02
KP					-	0,54	-0,04
TS						-	-0,27
UN							-
p < 0,01							

Table 2. Pearson correlations (Source: own elaboration)

Subsequently a t-test was performed between respondents who had a lower UN/TS ratio and those who had a higher UN/TS ratio (below and above the mean value). As expected, there were statistically significant differences for all categories with respondents who had higher UN than those who had lower UN (see Table 3). Respondents who had lower levels of uncertainty anxiety in relation to electrical engineering are also likely to have a better relationship with the subject, and probably prefer and do better with electricity in their teaching with their students. Similar to the results of the UN/TS correlation, it was found that for TD, MGP and S, there were significant differences for teachers with lower TS values than those with higher TS (see Table 4).

According to the responses and analyses conducted, it can be concluded in relation to the first question that novice teachers, equipped with technical skills and basic knowledge of electrical engineering, have confidence in their approach to teaching about electrical engineering and thus can probably inspire, guide their students, respond appropriately and interpret their questions, supported by digital tools. The second research question explored the interrelationships between the two factors and the other dimensions of technical or

electrical literacy mentioned above, leading to a comparison of results between teachers with lower TS/UN and higher TS/UN. Technical Self-sufficiency was positively correlated with all criteria, while Technical Anxiety was negatively correlated with TD, MGP, and S. Technical Anxiety was not significantly correlated with AT and KP, indicating that teachers who are afraid of electrical engineering naturally resist activities in electrical creativity and their critical outlook towards electrical engineering in education is significant. This was particularly evident among primary school teachers.

	Lower UN		Higher UN		T
	Average	Deviation	Average	Deviation	
TD	5,92	0,99	6,54	0,56	-7,08
MGP	5,08	1,35	6,05	1,02	-7,51
S	3,94	1,25	5,13	1,24	-8,90
AT	2,10	1,04	2,79	1,30	-5,54
KP	3,16	1,02	4,22	1,09	-6,33

Table 3. T-test results between lower UN and higher UN (Source: own elaboration)

	Lower TS		Higher TS		T
	Average	Deviation	Average	Deviation	
TD	6,47	0,68	6,03	0,95	4,93
MGP	5,90	1,03	5,28	1,44	4,59
S	4,72	1,51	4,42	1,21	2,04
AT	2,44	1,28	2,49	1,18	-0,38
KP	3,74	1,31	3,70	1,06	0,30

Table 4: T-test results between lower TS and higher TS (Source: own elaboration)

Conclusion

The issues discussed here emphasize the field of electrical engineering as one of the partial and necessary components in the preparation of a future teacher in this field, whether he or she will be working in primary or secondary school. The level and scope of the preparation of such a teacher must include both the theoretical and practical areas related to this field, which the future teacher must understand, navigate and interpret in order to adequately transform the scientific knowledge of electrical engineering into the teaching process, but also to be able to engage and motivate his/her students to study.

The preparation of teachers of electrical engineering requires their quality preparation both professionally and didactically, which is very demanding both theoretically and practically. The demanding nature of the training is due not only to the fact that they must absorb knowledge of electrical engineering during their studies, but also of pedagogy, psychology and didactics, and that, in addition to theoretical knowledge, they must also master a certain practical aspect linked to manual activity and teaching skills - a certain mastery of the teacher.

The use of contemporary possibilities of technology gives stimuli for the implementation of the preparation of future teachers in higher education with other, not yet anchored techniques and methods, which, although they are still "in search" (also due to the fact that

the development of technology is at speeds that have not been considered realistic so far) and are part of the discussions of expert panels at many levels, but at the same time these stimuli are an excellent preparation of future teachers for their own teaching practice. Now more than ever, we can say that the preparation of future teachers is beginning to correspond in real time with the demands and requirements placed on them in the reality of today's schools.

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Chatbots as a Learning Tool

Artificial intelligence in education

Nikola Straková¹, Jan Válek²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1259>

Abstract

Artificial intelligence is entering the educational process as a new element influencing both pupils/students and teachers. This article explores the significant use of AI in the education process and provides insight into the perspectives of both parties – pupils/students and teachers. As part of our research, university students were asked about their views and experiences with AI in education. This allowed us to better understand their wants and needs. AI is viewed positively if it enhances the learning process and does not sabotage pupils/students' personal interactions with teachers. AI will help teachers with grading and generating tasks, saving them time and allowing them to focus more on interacting with pupils/students. AI will help teachers with assessment and task generation, saving them time and allowing them to focus more on interacting with pupils or students, helping them to better understand the needs of the classroom and tailor their teaching. A key point is preparing teachers to use AI effectively in the classroom.

Keywords: Artificial intelligence (AI), Chatbots, Effective use of chatbots in education

1 Introduction

At first glance, it would seem that artificial intelligence (AI) has spread very quickly in society, almost by leaps and bounds. But the truth is that it has gradually developed and slowly integrated itself into the technical tools we commonly use (for example: apps in smartphones to solve mathematical equations; apps that recognise plants or objects with links to eshops; apps for learning languages). AI has come among us and is not going anywhere. It will continue to improve. Just as calculators have made it easier for us to do maths, Google to find information, Google translator to translate from other languages, so too can AI tools help us in everyday life and in teaching.

It is nonsense to prohibit the use of artificial intelligence by pupils in the education process. Firstly, pupils/students will always find a way to use AI despite the ban (minimum own mobile phone) and then, where else but at school should pupils and students be guided to master the

¹ Faculty of Education, Masaryk University, Pořčí 7, 603 00 Brno. Czech Republic.

E-mail: strakova@mail.muni.cz

² Faculty of Education, Masaryk University, Pořčí 7, 603 00 Brno. Czech Republic.

E-mail: valek@mail.muni.cz

rapid technological advances that are changing the world. This is actually the biggest reason not to ban AI in the classroom. Today's pupils/students are entering a world full of generative artificial intelligence programs. For today's pupils/students to be good citizens in the future, they will need hands-on experience with AI. They should understand how this type of AI works, what its characteristics are, what strengths and weaknesses it has, and how it can be exploited (Roose, 2023). The goal of teachers should be to equip pupils/students with competencies for a future with AI.

Developed countries such as South Korea and the United States are already preparing intensively for the integration of artificial intelligence into the curriculum of primary and secondary schools. In the future, students are expected to possess, according to Kim et al (2021):

- 1) knowledge of artificial intelligence,
- 2) skills related to the use of artificial intelligence
- 3) and my own attitude towards artificial intelligence.

The Czech Republic is currently working on the development of an AI curriculum for primary schools with a focus on secondary schools. The curriculum is being developed by AI for Children in cooperation with the National Pedagogical Institute, a group of academics from prg.ai and Aignos, an association focused on AI education. The educational content should cover the following areas: understanding AI technologies, developing skills with AI applications and understanding the impact of AI on society (AI for Children, 2023).

In this context, we feel that there is a need to ascertain the views of future teachers of practical education on this issue.

2 Goals

Chatbots, as one tool for the practical application of AI technologies, are nowadays standardly used in customer service in various industries. In the form of virtual assistants, they replace human contact. But chatbots can also be a very interesting teaching tool. The main goal of this paper is to see if chatbots can be used appropriately in education.

The main goal breaks down into the following sub-goals, which we want to find out:

- How a chatbot can be used as a teaching/learning tool.
- How a chatbot can be used as a learning tool/tool in teaching.
- How respondents want to further their education in AI.
- How to constructively incorporate chatbots into teaching.

3 AI in Education

According to the National Strategy for Artificial Intelligence in the Czech Republic (2019), education plays a crucial role in minimising the potential negative impacts and maximising the

opportunities that AI brings to the economy and society. With the advent of AI, the National Strategy for Artificial Intelligence (2019) states that the education system needs to be adjusted to focus on lifelong learning through the following activities financially supported by the government:

- the development of methodological support,
- expanding the range of university study programmes and courses in AI, continuing professional education and retraining,
- development of digital competences and computational thinking of pupils and students,
- updating the framework education programmes,
- introducing appropriate elements for teaching AI skills at all levels of school.

Unicef (2023) states that children or youth make up a large proportion of AI users, but most AI systems do not allow young users to make informed decisions about how to interact with AI (how, when, what data is collected about them, how the data is used, how content is created for youth, etc.). Better information for children or youth about how companies, tools, platforms or individual content working with AI work is recommended as an appropriate solution to these negative impacts of AI on youth (Unicef, 2023).

Simply giving information to pupils/students without their active participation is not effective. The best learning outcomes for pupils/students will be achieved if they use and actively practice the ideas, knowledge and skills they are learning (Petty, 2009). Therefore, the best way to teach about AI technologies is to use them. How teachers, pupils and students can realistically and appropriately use one of the AI tools is the focus of this paper.

AI is a general term used to name activities where a machine does something that would normally require human intelligence (Lane, 2021).

There are many different techniques to get a machine to replace human intelligence.

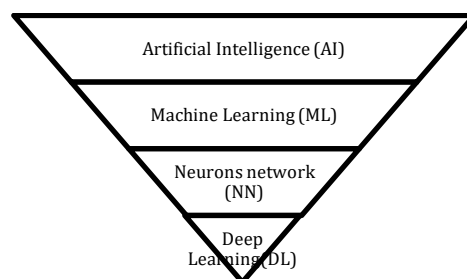


Figure 1: The relationship between AI and its components (Lane, 2021)

The most essential sub-form of AI is machine learning (a computer learns to solve problems using examples presented). One type of machine learning is the Large Language Model (LLM), also called generative AI because it can generate new content instead of just analysing existing data (Baker, 2023). This paper focuses on chatbots that are explicitly powered by machine learning. In doing so, we focus more on the practical applications of chatbots than on understanding the technology itself.

3.1 Chatbots

Chatbots were created for human-artificial intelligence communication. These are computer programs that allow users to interact with AI. Specific chatbots include ChatGPT, Bing AI, Google Bard, Perplexity, Copilot, etc. Chatbots mimic human conversation and are increasingly being used for customer service purposes, for example, in communicating with a customer to review a particular product or service, to answer common customer questions, as virtual assistants to order a product or service, to help select a product or service, and to answer questions about a product or service (Lane, 2021). But there are many more possible uses of chatbots. Baker (2023) predicts that chatbots are most likely to replace humans, who collect, analyse, use and disseminate knowledge of various kinds in their work. Generative AI technologies in the form of chatbots are likely to be used significantly across all industries, businesses and services. They are already being encountered in the following sectors, according to Baker (2023):

- medical research and development,
- biohacking,
- healthcare,
- education,
- media,
- marketing and advertising,
- legal,
- art,
- retail,
- financial services,
- research,
- search engines,
- library science,
- publishing.

3.2 Chatbots in Education

The use of GPT Chat in formal education raises concerns for many about cheating on homework. However, this concern can be overcome by the ability of teachers, pupils and students to use the potential of chatbots to the maximum. According to Roos (2023), schools should adopt chatbots as a useful school tool and in no way as a substitute for teachers or pupils/students. Roose (2023) gives several examples of how a chatbot can be helpful for teachers' work and pupils/students' learning:

- using chatbots to create outlines for essays (chatbot will help deepen understanding of the topic, and teach how to interact with AI models),

- The chatbot can tailor instruction to the specific learning style of individual pupils/students (for example, explaining Newton's laws of motion to a visual-spatial student),
- the chatbot will help with the genesis of ideas for activating pupils/students in the classroom (for example, it will write a script for production on any topic),
- A chatbot can serve as an after-hours tutor (for example, explaining Archimedes' Principle using language an eighth-grader would understand),
- pupils/students can discuss with the chatbot as if it were their debating partner (they can ask it, for example, to convince them that animal testing should be banned),
- Even the shortcomings of chatbots (such as the fact that their answers to factual questions are often wrong) can become useful for training critical thinking (for example, teachers can ask pupils/students to evaluate the chatbot's answers as a teacher would evaluate a pupil's/student's answers),
- The chatbot can also help teachers save time when preparing for a lesson (for example, to generate quizzes).

Andrew Herf (2023) from St. Joseph's College of Engineering in A Teacher's Prompt Guide to ChatGPT wrote many creative ideas for teaching with chatbots. ChatGPT can create, for example:

- worksheets including learning objectives and the criteria needed to master them,
- glossaries and definitions,
- arguments for and against,
- mind maps,
- their own stories,
- tasks and assignments adapted to the needs and abilities of each pupil or student,
- quizzes and tasks to verify information,
- curricula that meet the needs of pupils in terms of content and scope,
- basis for feedback, independence, self-reflection and monitoring of pupils' efforts,
- guidelines for motivating pupils and students,
- guidelines for assessing pupils and students,
- and much more (Herf, 2023).

For more examples of effectively incorporating ChatGPT into teaching practice, we recommend reading Andrew Herft's ChatGPT Teacher's Guide (2023). Table 1 shows examples of how a chatbot can help with teaching and learning according to Miller (2022).

Table 1: Examples of how a chatbot can help with teaching and learning (Miller, 2022)

	Type of activity in the lesson	Description
1.	A comprehensive source of information	A basis for effective conversation and discussion of the topic.

		Use the chatbot as a source of information and answers to a variety of questions (especially for difficult material to understand).
2.	A sample of good examples	When pupils and students see enough good examples, they realise what is good (a good essay, good reasoning, good logic), and they can imitate it (much like a writer or painter imitates the greats).
3.	Remixing works	The pupil or student writes a story, essay, poem, report, or revision of the material and then asks the chatbot to remix the work for him/her as a nursery rhyme, children's book, etc., showing the pupils new opportunities.
4.	Individualised educational resources	Create personalised learning resources (content, methods, forms, teaching aids) that are adapted to the content and pace of learning, needs and abilities of pupils/students. Ask him to define concepts, laws, and phenomena at different levels (for example, so that a 10-year-old child can understand it).
5.	Feedback	For example, feedback on a written essay might look like a list of a few suggestions for improving it - add more examples, break it up into shorter paragraphs, use this phrase, etc.
6.	Inspiration to prepare for teaching	Ask the chatbot to prepare the lesson for you - quizzes, discussion topics, examples, ...
7.	Finding more resources for teaching	Ask the chatbot to supplement your personal learning by providing additional resources, materials, etc.
8.	Creation of thematic plans	Ask the chatbot to write a topic plan for the lesson based on the curriculum documents provided. Then, modify the plan according to your needs.
9.	Discussion participant	Incorporate it into think-pair-chatbot-pair-share discussions. Pupils or students think about the topic on their own, then discuss it with a classmate, then use the chatbot, discuss what they found with a classmate, and finally share their findings with the whole class. Let the pupils/students debate with the chatbot. They can ask the chatbot to refute some opinions or provide arguments. Use the chatbot to gain insight into big, intractable problems like world hunger. The chatbot will either solve the problem, provide insight into the resolution process, or tell you why the problem can't be solved.
10.	Ask	Ask the chatbot again...and again...and again the same question. The chatbot will produce an original answer each time. Pupils or students can select the best-generated versions to create a better final product.
11.	Peer review training	Rate the work of the chatbot. A chatbot has no feelings; it is easier to criticise its work than to risk negative feelings from

		pupils/students because it has messed up. For example, have the chatbot write an essay and then have the pupils/students grade it according to the assessment criteria provided.
12.	Repetition of the syllabus	Ask pupils/students to predict the response they will get from the AI. For example, "What do you think the chatbot will say when I ask it to summarise what you have learned in the past hour?". Pupils/students will recall knowledge from their memory, strengthening their long-term memory. The chatbot will probably not list everything; pupils/students will justify why and what is missing.
13.	Teacher, after working hours	Use AI to provide one-to-one tutoring or coaching for pupils and students.
14.	Advisor, expert, friend	Pupils and students can ask the chatbot for advice in various situations, e.g., stress management, relationships, mental well-being etc. The chatbot can thus replace advice from friends, family, strangers, etc.
15.	Summary of texts	Use it to summarise texts (chapters, subchapters, scenes etc.). Summaries serve well for revision before a test, an exam, or from someone else's perspective.

From these examples, it is clear that a chatbot can be a perfect tool for planning lessons and inventing different activities for pupils or students. Working with it is simple and fast. However, Baker (2023) also points out the negatives associated with the use of chatbots. Chatbot responses can be inaccurate and qualitatively different, answers that sound convincing can be wrong, conversations are not private, and the creative content generated is not currently protected by copyright law in the US or the Czech Republic. For a better chance of getting correct answers to the more difficult questions, we may recommend asking questions in English. In any case, however, it is advisable for the interviewer to critically evaluate the answers obtained before using them, for example, in teaching.

4 Methodology

A survey research method is used to determine whether chatbots can be used appropriately in education and in what specific ways. The questionnaire was filled out by students of Teaching Practical Education and Teaching Vocational Subjects at Masaryk University in Brno during the autumn semester 2023. 98 students were contacted, 30 students completed the questionnaire and the return rate was 31%. The questionnaire was distributed online via Google Forms and the results were processed using commonly used Microsoft Excel software. The main research question of the survey was set as follows:

- Where do respondents see the potential of using chatbots in education.

The following sub-questions were defined for the main research question:

- Where do respondents see the potential of using chatbots for learning?
- Where do respondents see the potential for using chatbots in education?
- In what areas of AI do respondents want to further their education?
- What form of education do they prefer?

The chatbot from OpenAI, ChatGPT, was used to demonstrate communication with artificial intelligence. ChatGPT was developed by OpenAI in November 2022. ChatGPT is available at <https://chat.openai.com/>, where you can start using it after logging in. The version of chatGPT that we use is 3.5. This version is unpaid and provides up-to-date information valid until January 2022.

5 Results of the Questionnaire Survey

30 respondents took part in the survey. Practical Teacher Education students made up 70% of the respondents, and Vocational Teacher Education students made up 30% of the respondents. Regarding the form of study, 57% of the respondents were full-time students, and 43% were students from the combined form of study.

The majority of respondents (80%) have tried interacting with a chatbot at least once. When asked what they could imagine using a chatbot for as a student, respondents selected the following as the most appropriate activities:

1. to summarise longer passages of text,
2. to design the structure of the text,
3. fast discovery of information otherwise difficult to find in the original sources,
4. getting immediate feedback,
5. to search for different sources of published information,
6. to stylistic reformulation of the text.

Activities that respondents would not use chatbot communication for included:

1. direct formulation of the text itself,
2. completion of a written assignment,
3. solving your homework,
4. generating an argument,
5. generating conclusions.

In Figure 2 on the left, two groups of respondents and their ideas about the use of chatbots are shown. A comparison of the group of respondents working with a chatbot and those not working with a chatbot showed that those who work with a chatbot can imagine using a chatbot in most activities, which we expected. A contrary result would be a very strong incentive for further investigation. Positive values are obtained for most activities, which means that they are more likely to say yes (+1) or definitely yes (+2) to imagine using a chatbot

in them. Exceptions are the activities of *formulating summaries of longer passages of text* and *getting feedback*. Respondents who have not yet worked with a chatbot see more potential for these two activities.

In Figure 2 on the right, we see a comparison between groups of respondents differing on whether they consider chatbots as a suitable or unsuitable tool for education. Here it can be seen that the group of respondents considering chatbots as a suitable tool for education logically also see more potential in using chatbots in the activities offered. The only exception is the activity where the chatbot is used *for completion of a written assignment*. For this activity, respondents who do not consider the chatbot to be a suitable tool for learning imagine some potential use of the chatbot. The second group clearly excluded this activity.

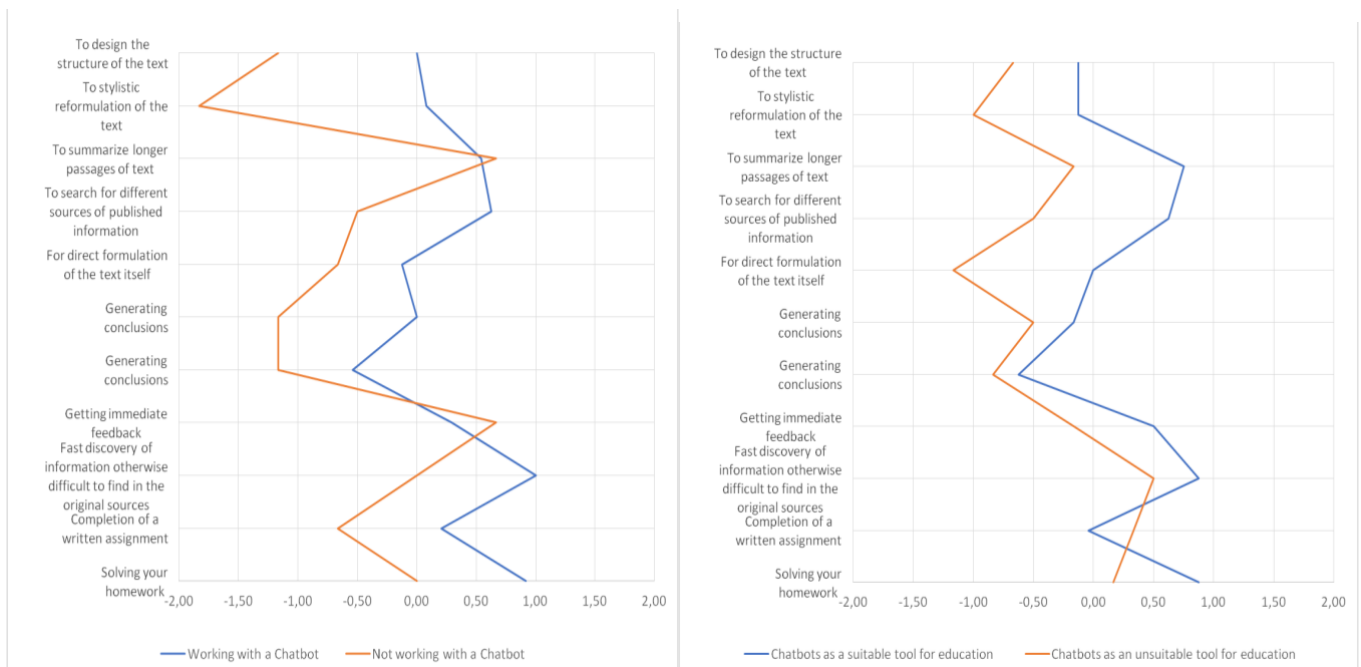


Figure 2: What can you imagine using a chatbot for in the role of a STUDENT?

Since the respondents were university student teachers, we asked them if they worked *under the guidance of their teachers with a chatbot in the classroom*. We found that only about one-third of the respondents (33%) use chatbots in their university education (30% rather use, 3% definitely use), and two-thirds do not (40% rather do not use, 27% do not use at all). Interestingly, the more significant potential for using chatbots in teaching is seen by those who do not use them under the guidance of their teachers, see Figure 3.

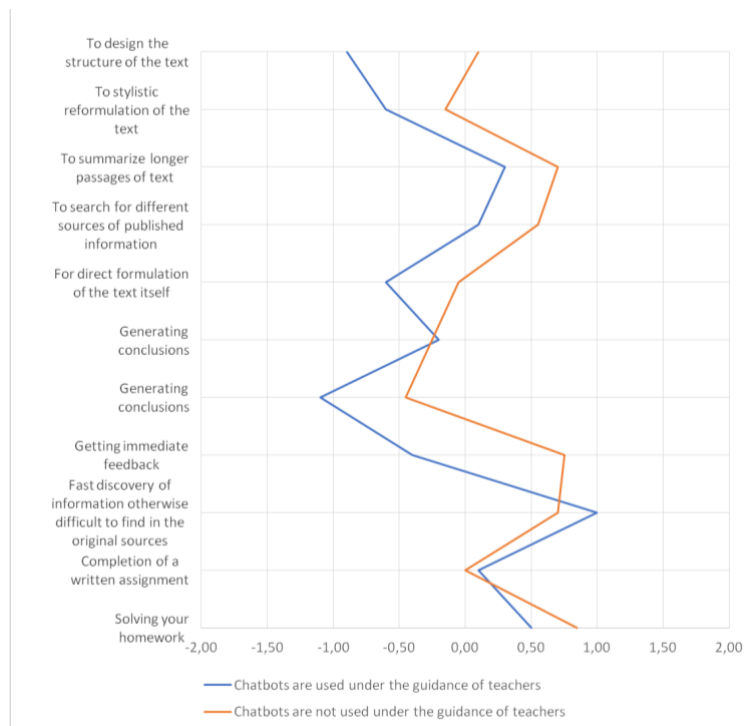


Figure 3: Potential use of chatbot in the role of STUDENT using and not using chatbots in teacher-led learning

In the next part of the questionnaire, we asked respondents to answer from the position of a teacher as their future profession. When asked what they could imagine using a chatbot for in their role as a TEACHER, respondents selected the following as the most appropriate activities:

1. generating ideas for activating pupils/students in the classroom,
2. generation of test tasks, assignments and questions,
3. to actively use AI in teaching (the chatbot acts as a teaching tool),
4. as an aid in the preparation of research or to find sources of published information, etc.,
5. to generate lesson preparations,
6. to generate patterns to motivate pupils/students,
7. to generate tasks and assignments tailored to the special needs and abilities of each pupil/student (individualised teaching),
8. to generate recommendations for other teaching materials.

Among the activities for which respondents would not use chatbot communication in the role of TEACHER, they included:

1. activities that replace the teacher during pupils/students' self-study at home (chatbot = after-hours teacher, virtual teaching assistant),
2. to generate pupils/student assessment guides,
3. as a pupil/student's discussion partner,
4. to the direct formulation of the text itself,

5. to generate lots of good examples (good essay, good reasoning, good logic),
6. to ensure better organisation and planning of teaching (preparation of the thematic plan for the year, ...).

The ideas about the possible use of chatbots in teaching from the TEACHER's position and from the perspective of different groups of respondents (working X not working with chatbots) are shown in Figure 4. Respondents not yet working with chatbots, compared to those already working with chatbots, are more able to imagine their use in activities where the chatbot is a virtual learning assistant for home self-study and for activities leading to the generation of recommendations for further learning materials. For all the other 12 activities offered, those respondents who already have some experience with chatbots see more potential for their use in the role of teacher in teaching.



Figure 4: What can you imagine using a chatbot for in the role of TEACHER?

The use of chatbots by pupils/students during education is considered appropriate by 80% of respondents. Compared to those who considered the use of chatbots as inappropriate, all of these respondents are more likely to imagine using the offered chatbot activities in their own teaching where they will be in the role of a teacher, see Figure 5.



Figure 5: Potential use of a chatbot in the role of a TEACHER considering chatbots as appropriate or inappropriate for students' work in the classroom

90% of all respondents are interested in further education in AI tools for teaching and learning. Of the specific technologies using AI, the greatest interest was shown in the topic of image generation (73% of respondents), followed by general basics about AI (63% of respondents), generating personalised learning practices and methods (60% of respondents), and video generation (57% of respondents), see Figure 6 for more.

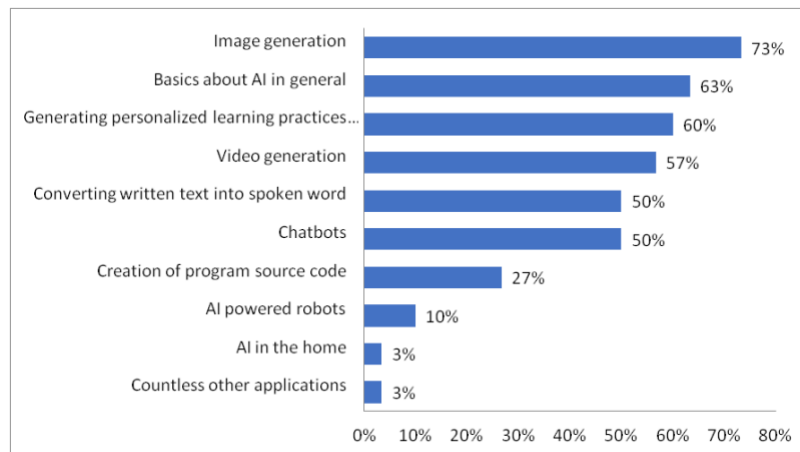


Figure 6: In which AI technologies would you be interested in further education?

What respondents clearly like most about communicating with chatbots is speed in various forms, such as a quick response in general, a quick search for information on a topic, or quick editing of text. According to the interviewees, another significant advantage of chatbots is the variability of answers and suggestions for possible solutions to tasks. Other advantages of chatbots are listed in Table 2 and were mentioned only sporadically. Table 2 also summarises the perceived advantages of AI in general. Again, speed is seen as the most significant advantage by the respondents. At the same time they emphasise that AI represents a future with great potential for use that will undoubtedly become a standard part of society.

Table 2: Perceived opportunity in communication with chatbots and in AI in general

	Spotted opportunities			
	Chatbots		AI in general	
1.	Speed of reply	40%	Speed of responses	20%
2.	Lots of possible solutions (variability of answers)	17%	It's the future	20%
3.	Nothing	10%	Solve the problem, give advice	13%
4.	Quality of answers	7%	I don't like	13%
5.	Independent view, without emotions	7%	Practical, easy to use	10%
6.	Structure	3%	Creativity of solutions	7%
7.	Irresistibility	3%		
8.	Creativity	3%		
9.	Development of critical thinking	3%		
10.	Links to original sources of information	3%		

In contrast, the shortcomings and risks associated with using AI and chatbots in teaching and learning are listed in Table 3. The two groups of most frequently cited threats are loss of

ownership (encouraging laziness, merely taking in information without thinking, not developing one's own skills enough, resignation to self-exploration and analytical thinking) and error (wrong answers, unreliability, uncertain quality of answers).

Table 3: Potential threats perceived in AI in general

Potential threats (AI in general)		
1.	Losing one's ideas and encouraging laziness of pupils/students	37%
2.	Incorrect answers from AI	37%
3.	Risk of cheating	13%
4.	Does not use Czech sources or uses incorrect sources	7%
5.	Risk of misuse of personal data	3%
6.	Unethical use	3%
7.	Replacing humans with AI in the future	3%

6 Examples of Learning Activities with Chatbots

In this chapter, we would like to show concrete examples of constructively incorporating chatbots into teaching. We believe that to maximise the benefits of AI, it should be used as a tool rather than as a substitute for one's skills, in this case, the skills of the teacher and the pupils/students in the course of learning. In the following subsections and the appendix of this paper, two teaching methods in which chatGPT is used as a teaching tool are described - the *modified Think-pair-ChatGPT-share method* and the *dramatisation of teaching*.

6.1 Modified Think-pair-ChatGPT-share method

The use of paired discussion work in the classroom is appropriate to incorporate when pupils/students are very unresponsive to the questions asked or when the questions are too challenging (Petty, 2009). In paired discussions, pupils/students are given more time to think and have the opportunity to check their answers with a classmate, which, according to Petty (2009), increases their confidence and ability to respond to the teacher's questions.

The Think-pair-share method is a cognitive and communicative teaching method which, according to Čapek (2015), includes three basic steps:

1. Pupils/students think about the problem presented by the teacher,
2. correct and refine their ideas in pairs,
3. he shares his thoughts with the whole class.

A modification of the Think-pair-share method is to incorporate AI as a teaching tool. The scheme of the method is transformed into think-pair-ChatGPT-share. We added one

intermediate step in the form of GPT chat to the teaching method. Before presenting in front of the class, pupils/students will evaluate and sort their notes and ideas once more using the answers obtained from the AI. This step will provide a deeper exploration of the material discussed, add another angle and enhance students' critical thinking.

For a specific demonstration of the application of the modified Think-pair-ChatGPT-share method, the topic Marketing on social networks was selected from the curriculum of the thematic area Marketing basics for secondary vocational education with the final examination ISCED 2011 - P354 (the essence of marketing, market research, product, price, distribution, promotion). Nowadays, social networks are an integral part of marketing. For this reason, they cannot be ignored. Pupils/students should know how social media marketing works. At the same time, this topic provides room for discussion due to the different influences on social media users. A specific example of the Think-pair-ChatGPT-share method assignment, including a sample response from chatGPT, is provided in the appendix of this article.

6.2 Dramatization Methods

Dramatisation methods in teaching develop students' aesthetic sensitivity and social skills (Čapek, 2015). In the dramatisation method, literary, musical and dramatic arts are synthesised. Dramatization method is understood in its extended sense, and so we include other related activities in it:

- games imitating reality and stylised games,
- movement games,
- sound methods such as reading, discussion, recitation, singing, etc.,
- graphic methods such as mind maps, questionnaires and tests, posters, etc,
- working with objects (paper, props, costumes, etc.).

Drama in the classroom is an effective educational method that increases pupils/students' self-esteem, allows previously inexpressive pupils/students to shine, and promotes empathy, understanding of life experiences, and identification with characters in dramatic scenarios (Petty, 2009). An alternative to dramas, which should have powerful emotional instruction, is the teaching method of role-playing (Petty, 2009). Role-playing is very useful for developing interpersonal and social skills in pupils/students, particularly in business and service industries, as it allows them to practice skills in a safe, risk-free environment (Petty, 2009).

How can GPT chat help with the dramatisation of learning? According to Petty (2009), before the actual drama or role-playing, it is necessary to provide pupils/students with all the background information about the production and, where appropriate, show examples of good or really bad practice in order to achieve the stated learning objectives in the outcome (for example, practising asking questions when selling goods). GPT Chat can generate different scenario variations very quickly. Chat GPT can transform text into a story that can be used as a script for a production, or as an introductory motivational story in a lesson, or additional learning material for pupils/students' own learning. Chat GPT can transform text into a poem.

The poem can be recited by a pupil/student in class, can be the basis for a production, or can serve as a mnemonic for learning. The generated poem is not always perfect in all respects, so pupils may be encouraged to correct it before using it. A dramatization of specific learning content is provided in the appendix of this article.

7 Discussion

In this discussion, we consider the potential risks associated with using chatbots in the role of pupil/student. Activities such as formulating summaries of long text passages, suggesting text structure, providing feedback, and reformulating text represent using chatbots as a tool, not a substitute for learner work. These activities could be further developed with pupils and students to maximise their potential benefit. On the other hand, we see possible risks associated with using chatbots in activities such as *discovering information that is difficult to find in original sources*, *generating arguments and conclusions*, and *formulating their text*.

The risk of artificial intelligence replacing the original sources of published information is compounded by the impossibility of discovering the true original sources. It is likely to be quicker and more convenient for the pupil/student to find out the required information from AI, as opposed to finding it in its original form from books, articles, research results, etc. This runs the risk of the information being cited as if it was found from the original sources but was generated by the AI. Unless there is a critical evaluation of the information, there is a risk that misinformation will be spread. In the worst case, pupils/students and learners may leave their work to the AI altogether. Unfortunately, it is currently very difficult and unrealistic to reveal whether the work was written by the AI or by the pupil/student.

Another potential risk is the use of AI to formulate the text itself, i.e. to generate arguments and conclusions, or even to directly formulate the text itself, for example, when writing a thesis, term papers, etc. If it is about the pupils/students' own opinions on a particular topic and drawing his/her own conclusions on a particular issue, the pupil/student, as the author of the work, should formulate them independently. According to the current copyright law in force in the Czech Republic, the author of a work can only be a natural person, not an AI. Therefore, the work must be the result of the author's creative abilities. Given the undetectability of the use of AI in the writing of various works, the solution to this concern lies mainly in the ethical, responsible and honest use of AI.

8 Conclusion

This paper focused on chatbots in the educational process, specifically in teacher training. We pointed out the possible problems in using them but also showed the possibilities of constructively incorporating work with chatbots into teaching.

As part of the paper, we surveyed prospective teachers about how they envision or may already be using this tool in their preparation for teaching or during their studies. The

questionnaire was divided into a section where respondents answered questions about using chatbots in the role of a student. In the role of a teacher, they could express the opportunities that AI/chatbots offer or their concerns that using AI entails.

The questionnaire survey results show that 80% of respondents have experience communicating with chatbots. However, only 33% of the respondents work with chatbots under the guidance of a teacher in the classroom. Respondents answering from the position of a student who already has experience working with chatbots see more potential in activities related to chatbots in the classroom.

80% of the respondents from the position of a teacher consider it appropriate to use chatbots in the education of students. However, only 33% of them work with them in their college teaching, where they prepare for their future profession as a high school teacher. It was shown that if the respondents have experience working with chatbots, then they also see more opportunities and possibilities of using chatbots in various activities related to teaching their future students. 90% of the respondents are interested in further education in AI tools applicable to teaching.

The three main advantages and reasons why it is good to use chatbots and other AI tools in education, according to the survey respondents, are *speed*, *future technology*, and *variability of solutions/use*. Technology that offers acceleration of activities expands the repertoire of possible solutions and is one of the newest developments of the time. It clearly increases the efficiency of the work in our case of the teacher and his/her pupils/students. On the other hand, the respondents of the questionnaire survey are also aware of the negatives associated with the use of chatbots and, more generally, AI in teaching. The main concerns they see are the decrease in the level of their own abilities (thinking, researching), errors and cheating. We see a solution to eliminate these disadvantages in the way AI is used in education. AI in its various forms must be used as a tool, not as a substitute for one's own abilities, in this case, the abilities of the teacher and the pupils/students.

All of these benefits and risks are realised, which is why future teachers need to be exposed to them during their preparation for the profession during their university education. Teachers should be aware of the positives and negatives of working with chatbots and should actively draw their students' attention to it, so that they do not just blindly trust these tools but think about and critically evaluate the results obtained and whether they are realistic. For the same reason, it is still necessary for pupils to acquire a basic body of general and professional knowledge. This will minimise their being misled by fraudulent data and information.

The topic of integrating AI into teaching is a hot topic at the moment and it is necessary to pay attention to this topic to ensure that future teachers are prepared for student-teacher-teaching-practice collaboration through chatbots and other AI tools and that they develop it in the right direction if possible.

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9 Appendix

9.1 Example of the Think-pair-ChatGPT-share teaching method

Table 4: Proposed assignment for the Thing - pair - ChatGPT - share activation discussion method

Subject: Basics of marketing
Topic: Social Media Marketing
Questions for discussion:
<ul style="list-style-type: none"> • What does it mean to be a product on social media? • Social networks as a tool for making money - for whom? • Tailored content - are social networks eavesdropping on us via mobile phones? • Sharing, reviews, comments - a good servant but a bad master?
Note: All students can work on all or only one topic in a pair. The topics can be extended so that each pair has a different topic.
Description of the activities in each phase:
<ul style="list-style-type: none"> • Think - write on a piece of paper what you can think of for each topic to discuss • Pair - compare your notes with a classmate in pairs, evaluate and sort your ideas • Chat GPT - ask the AI what it knows about each topic, critically evaluate the answers received from the AI and incorporate them into your notes • Share - share what you have learned with the whole class

Note: The method of presentation in front of the whole class can take different forms (oral in the classroom, in front of the board, with or without a presentation, prepared in the form of a report, etc.).

Table 5: Sample ChatGPT response to the question What does it mean to be a product on social media (ChatGPT via chat.openai.com, 2023)

The statement that "the product of social networks is human" can be interpreted differently and often depends on the context in which it is said. Below are some possible interpretations of this statement:

1. **Personalisation of content:** This can refer to the fact that social networks track user behaviour, collect personal data and use this information to personalise the content users see. This means that they create specific content that matches each user's individual interests, preferences and behaviour.

2. **Social capital:** This may be relevant in the context of social capital, which is the value of social relationships and networks. Social network users can be considered "products" because their social capital (number of friends, followers, interactions, etc.) can measure their social influence or value in the online space.

3. **Social media addiction:** in the context of the psychological impact of social media, this could mean that people become 'products' in the sense that their thinking, behaviour and self-concept are influenced or shaped by social networks. For example, there may be comparisons with others based on their social media presence, which affects their perception of themselves.

4. **Economic perspective:** From an economic perspective, this may refer to the fact that social media users generate value for these platforms. Their activity, interaction and data provide the basis for ads and other forms of monetisation, making users a kind of 'product' or source of value for these platforms.

Overall, the statement can be interpreted differently, and its meaning can be influenced by a wide range of factors, including social, economic and psychological aspects.

9.2 Example of Dramatization of Teaching

Table 6: Proposed assignment for the dramatization of teaching Marketing mix

Educational programme: secondary economic education with the matriculation examination ISCED 2011 - P354

Subject: Basics of marketing

Topic: Marketing mix

Teaching content:

The 4P marketing mix is a method of determining product strategy and product portfolio. It comprises four components: Product, Price, Place, and Promotion. Product is the name of a product or service. Its characteristics from the customer's point of view are quality, reliability, brand, design, warranty, service and other services, etc. Price is the price of the product and the overall pricing policy of the company. Place (distribution channels) means how a product is distributed from its manufacturer to the final customer. Promotion means how the product is promoted.

<p>Some authors add other components to the marketing mix. For the services marketing mix, the 7P model is used: People, Process, Physical Environment, Politics, and Public opinion. People (somewhere as Personnel) are the people who facilitate the interaction between the service provider and the customer. Process means a more detailed focus on how the service is delivered. Physical environment (Physical evidence) describes the physical environment. Philip Kotler adds Politics and Public opinion to the marketing mix. Other authors inflate the marketing mix with Packaging, Personal selling and Passion. This may be unnecessary as these P's are already included in the Promotion.</p> <p>The 4P marketing mix looks at promotion from the perspective of the company (seller) An alternative to the 4P is the 4C marketing model, which describes the marketing mix from the customer's perspective.</p> <p>What is the marketing mix used for in practice? When developing a marketing strategy and marketing plan, it is important to understand precisely where you stand in the market and to work with the marketing mix. A well-crafted marketing mix will combine all the variables to meet the goals set.</p> <p>Source: Kotler & Keller (2013)</p>
<p>Suggestions for dramatising the curriculum</p> <ul style="list-style-type: none"> • Scenario in the form of a story or fairy tale - you don't want ChatGPT to generate a story/fairy tale based on the copied content to use as a scenario • A poem as a basis for dramatisation of the topic or as a mnemonic device -
<p>Note: Roles and instructions may or may not be accurately communicated to students. If you give the pupils freedom, they will feel more involved and enjoy adding details to the scenario.</p>

Table 7: Poems from Chat GPT (ChatGPT via chat.openai.com, 2023)

<p>In a world of market and commerce where ideas intersect, the dance of the four Ps as the orchestra plays on stage.</p> <p>Product first as a hero in the series, quality, design, warranty - are his castle.</p> <p>Cena enters, striding out with grace, pricing strategy, in a package of harmony.</p> <p>Distribution as a dancer great, paths like trails in a labyrinth unreal.</p> <p>Graduation in the hand of a flashlight shining, advertising, PR, like the poet's creative verse.</p> <p>But let's not forget the people, the process, and the environment, that adds to the mix the beauty and comfort we take from nature.</p> <p>The light in the darkness is politics and public opinion, that influences dance marketing, with refinement and a sense of social direction.</p>	<p>Four letters are dancing on the store's stage, Product, Price, Place and Promotion, as the notes in the tact.</p> <p>A product like a bright star in the sky, Quality, brand, design, everything that brings us closer to the love in the heart of the customer.</p> <p>Price, as the notes of the music tuned, pricing strategy, in a world of money like a magic hammer playing.</p> <p>The place, the dance of distribution, the roads like handcuffs, from the manufacturer to the customer, as the handcuffs connected.</p> <p>Graduation, to the rhythm of advertising and promotion, music of words that persuades the customer to sing along.</p> <p>People and process, dance services personal, in a physical environment where well-being grows like a flower in spring.</p>
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<p>And so these P's play together in harmony, in a marketing dance where goals are met with love and passion beautiful.</p>	<p>Politics and public opinion, they play their part, in this symphonic mix where marketing is a beautiful and clever art.</p> <p>And so we spin, to the rhythm of the marketing mix, where all the Ps together form a melody of success, like a beautiful symphony in the night.</p>
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Table 8: Story (ChatGPT via chat.openai.com, 2023)

The story of a marketing mix that reflects the reality of today's market economy

In a city where the buildings rose to the sky and the streets pulsed with activity, there lived a businessman named Alex. His business was modern and dynamic, just like the market economy he followed. He knew that to compete in the business world, he needed a precise plan, and that included the right marketing mix.

Alex started with Product, his product range, which had to align with current trends and customer needs. Quality, design and high value were the key factors that allowed him to offer products considered the best on the market.

Price has become his strategic tool. He monitored price movements in the market, studied the competition and reacted sensitively to changes in demand. Pricing became like the notes in an orchestral piece, where every change impacted the overall harmonic picture.

Location and distribution were like a transportation network in a modern city. Alex focused on online platforms and rapid distribution to make his products available to customers quickly and efficiently. It was the dance of the modern age, where trails led through digital spaces.

Graduation has become digital theatre. Social media advertising, influencers, and modern PR strategies created a compelling story about his brand. Every post and every ad was like a piece of the puzzle that shaped the overall picture.

People and processes were key elements in its modern business model. Alex invested in technology to make processes efficient and simple. His team was like a well-tuned orchestra, where each member had a role in creating a unified sound.

The physical environment of his store was digital, and yet he was able to create an atmosphere of comfort and trust. It was a virtual business world where customers could shop comfortably while feeling part of a community.

Politics and public opinion became factors that Alex watched with caution. The economy was like a shifting orchestra, with political decisions and public sentiment influencing the tone of the entire sector.

And so Alex, with this modern marketing mix, has steered his business to success in the ever-changing market economy world. It was a story of adaptation, innovation and the ability to read the notes the market was playing.

Teacher Interaction from the Perspective of University Students

Teacher Interaction in the Classroom

László Dávid Szabó¹, Kinga Horváth²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1260>

Abstract

From our previous research conducted among teacher candidates, we could conclude that attitude plays a prominent role in the student's relationship with the subject, to which the teacher's interpersonal behaviour contributes greatly. For this reason, our goal is to examine the characteristics of the teacher's interpersonal behaviour from the teacher's and student's perspectives. Our research aimed to determine the teacher's interaction style from the students' perspective using the QTI measurement tool (Questionnaire on Teacher Interaction). The research aimed to assess how students see the teacher's classroom activities. In our research, we used the QTI questionnaire revised by Wubbels among university students majoring in English. The questionnaire contained 48 items. With the help of our survey, we want to examine what the teacher's interaction activity is like according to themselves, according to the students, and whether there is a difference between the teacher's point of view and that of the students. The QTI measurement tool can serve as a valuable source of information for teachers in comparing their self-assessment with the student's view, which can obviously enhance their professional development.

Keywords: Teacher interaction, Survey, Questionnaire, QTI, University student

1 Introduction

Our previous study (Szabó, 2023) aimed to investigate whether the methodology of teaching History can change. The research revealed that teachers play a significant role in their students' career choices and contribute to securing the next generation of teachers, as many students choose teaching as their profession because of their personal experiences during

¹ J. Selye University, Komárno, Slovakia.

E-mail: szabold@yahoo.fr, 122875@student.ujs.sk

² J. Selye University, Komárno, Slovakia.

E-mail: horvathki@ujs.sk

their studies. The research was conducted among students majoring in History Education at J. Selye University. The total number of students in the Education of History Programme is 89. The total number of students completing the questionnaire was 83 (44 male and 39 female respondents). In the case of 58% of the examined sample, a specific History teacher influenced the students to choose an Education in History at the university. Since the influence of teachers in choosing professions has been proven, we addressed to examine the interaction between students and teachers in the classroom. Only a few scientific sources in Hungarian were published regarding the issue.

Kinga Horváth and Péter Tóth (2019, 2022) have published a monograph and several studies in Hungarian. The present study examines the interaction style and interpersonal behavior of a teacher of English at a university in Hungary from the students' perspective. The English version of the QTI questionnaire was applied.

2 Theoretical Overview

Research has already been conducted on the impact of teacher behaviour on student performance in the classroom. These studies rely on two research areas: teacher effectiveness (Gordon, 1991; Zrinszky, 2002) and the examination of interactions between individuals and their environment (Tóth & Horváth, 2022).

According to Moos (1979), consistent use of a target skill by teachers (e.g., asking focused questions) results in that skill becoming a functional part of the classroom's ecological system. Several studies in recent years have focused on examining the relationship system between teachers and students (Telli et al., 2007; Wubbels, 2014; Passini et al., 2015).

One of the most significant findings from these studies is that positive interpersonal relationships benefit learning both in and outside the classroom. We can examine the interpersonal approach to the teaching process from several perspectives, including the teacher's interaction style from both the students' and teachers' perspectives. In our current research, we are examining it from the student's perspective. The study of the interaction styles of students and teachers was initially undertaken by Dutch researchers (Wubbels et al., 1985). They used the Model for Interactional Teacher Behavior (MITB). This model is based on Leary's interpersonal personality model (Leary, 1957). Adapting this model to the educational context led to the development of the Wubbels model of teacher interpersonal behaviour. The Wubbels model of teacher interpersonal behaviour distinguishes eight categories, illustrated in Table 1, as follows (Tóth & Horváth, 2022, p. 74):

Table 1: The model of interpersonal teacher behaviour

English acronym	The eight categories in the Wubbels model
ADM	Admonishing Behavior
DIS	Dissatisfied Behavior

HFr	Helpful/Friendly Behavior
LEA	Leadership Behavior
STR	Strict Behavior
SRE	Student Responsibility and Freedom Behavior
UNC	Uncertain Behavior
UND	Understanding Behavior

(Source: own editing based on Tóth & Horváth (2022))

The QTI questionnaire is a method used to assess the interactional teacher behaviour. It is based on the QUIT (Questionnaire for Interactional Teacher Behavior) questionnaire created by Wubbels et al. in 1985. The QUIT questionnaire originated from Leary's ICL (Interpersonal Check List) questionnaire, contained 77 questions, and was developed for Dutch high school students (Wubbels & Brekelmans, 1998; Wubbels et al., 1991; Wubbels et al., 1985; Wubbels & Levy, 1991).

Consequently, the original 77-item QUIT questionnaire was created in Dutch, to observe the teacher's classroom activities from the students' perspective. The Dutch version was followed by developing an English-language version of the questionnaire, first used in the United States (Wubbels & Levy, 1991; Wubbels & Levy, 1993).

Subsequently, the questionnaire was also tested in Australia (Wubbels et al., 1993). Wubbels and colleagues concluded that "the best teachers have strong leadership personalities, are more friendly and understanding, while being less uncertain, dissatisfied, and rejecting in behaviour than teachers in general³ (Tóth & Horváth, 2022, p. 100).

The questionnaire was applied in Turkey (Telli et al., 2007) with high school students, as well as in Singapore, Malaysia, Greece, China, and Slovakia (Fisher et al., 1995; Passini et al., 2015; Sun et al., 2018; Mareš & Gavora, 2004).

The Hungarian version of the QTI, elaborated by Tóth & Horváth (2022), investigated the ideal teacher's interpersonal behaviour. In our current research, we aim to apply the QTI questionnaire by Wubbels to determine the characteristics of teachers' interpersonal behavior. For this purpose, we have adapted the questionnaire to the Hungarian language. During the adaptation process, we used double back-translation, and we also had the wording of the questionnaire reviewed by practising educators. The interpretation of the octants in the Wubbels model can be found in Table 2.

Table 2: Interpretation of the Model for Interpersonal Teacher Behaviour

Name of the variable	Detailed description
DC/ leadership	notice what is happening; lead, organise, give orders; set tasks, propose solutions, explain, arouse the students' interest

³ Translated by László Dávid Szabó (LDSz).

CD/ helping friendly	assist, show interest in students' problems, involved, behave friendly and politely, have a sense of humour
CS/ understanding, consensus-oriented	listen with interest, empathic behavior, show confidence and understanding, initiate conflict resolution, be patient, open
SC /student responsibility, freedom	provide opportunity for independent work; wait for class to let off steam; give freedom and responsibility; take into consideration the proposals of the students
SO/ uncertain, indecisive	no intervention to happening, stay in the background, apologise, wait and see how the wind blows, admit one is in the wrong
OS / dissatisfied, doubtful	wait for silence, consider pros and cons, keep quiet, express dissatisfaction, eyes are angry, always ask questions, criticize
OD/ admonishing	get angry, short-tempered, forbid, warn for mistakes, punish
DO/ strict	control of students, strict exams, strict evaluation, getting class silent, maintaining silence, setting rules and norms, exercising rules

(Source: Tóth & Horváth, 2022, 76, trans. by LDSz)

The octants of the teacher's interpersonal behaviour can be presented along two axes, and the order of the octants is not random. Opposite sectors represent contrasting personality traits, while sectors closer to each other are more similar. There is no relationship between orthogonal sectors, meaning they are at right angles to each other when compared.

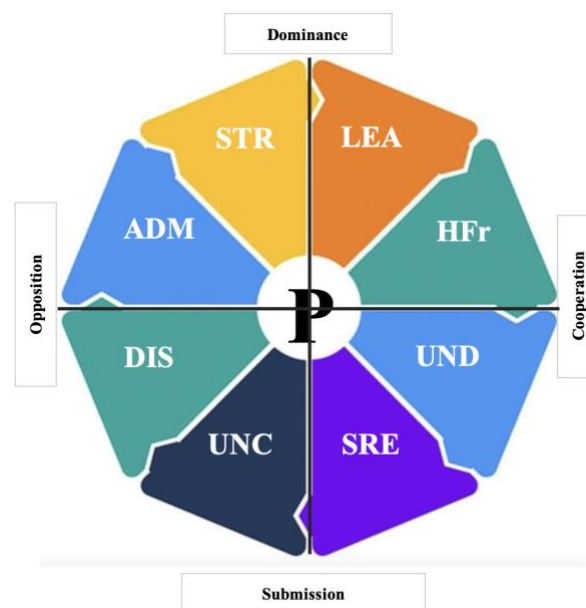


Figure 1: The model of teacher's interpersonal behaviour
(Source: own editing based on Tóth & Horváth (2022))

The teacher's interactional behaviour (Figure 1) can be interpreted along two axes. The letter "P" in the centre of the figure represents the teacher. In the figure, English Wubbels category abbreviations are shown in white, while Hungarian ones are in black. The vertical axis encompasses the extremes of dominance and submission, indicating the effort of the teacher to maintain their power position within the classroom or how much they delegate this role to

their students. The horizontal axis encompasses the extremes of resistance and cooperation, indicating how distancing or rejecting the teacher is or how helpful and understanding they are towards their students. The eight equal sectors in the coordinate system are labelled with LEA, HFr, etc., according to their position in the coordinate system. Both the LEA and HFr sectors are characterised by dominance and cooperation. In the adjacent sectors, dominance prevails over cooperation. For example, a teacher exercising the LEA behaviour may explain something to the class, organise groups, and assign tasks. The neighbouring HFr sector shows more cooperative and less dominant behaviour, indicating that the teacher assists students and behaves in a friendly or attentive manner (Tóth & Horváth, 2022). The current study uses English abbreviations.

3 Research Goals, Questions, and Hypotheses

The research aims to explore (C1) the interaction style and characteristics of the teacher interpersonal behaviour of a teacher of English at a Hungarian university from the perspective of English-major students, using the 48-item English version of the QTI questionnaire developed by Wubbels. Three groups participated in the research (14, 17, and 19 participants). The survey took place in three groups taught by the same teacher. Another objective of our research is (C2) to compare the obtained results based on the background variables of gender and groups, as well as (C3) to examine whether the students' assessment of the teacher's interaction style in the sample corresponds to the characteristics of the interpersonal behaviour considered ideal by teacher trainees. Considering these objectives, the following study questions were formulated before the research:

Q1. How can the interactive style and interpersonal behaviour of an English teacher at a Hungarian University be characterised from the perspective of English-major students?

Q2. Considering the background variables, what kinds of differences can be observed among the various groups of students in terms of teacher evaluation?

Q3. Does assessing the teacher's interaction style by students in the sample correspond to the characteristics of the interpersonal behaviour considered ideal by teacher trainees?

4 Results

As the first step of the research, we tested the reliability and validity of the questionnaire in the examined sample. Three groups of English primary students from a Hungarian university participated in the study. A total of 50 students completed the questionnaire, of which 24 were male and 26 were female (Table 3). There were 14 students in Group 1, 19 in Group 2, and 17 in Group 3 (Table 4).

Table 3: Gender distribution among the respondents

		GENDER			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	24	48.0	48.0	48.0
	female	26	52.0	52.0	100.0
Total		50	100.0	100.0	

Table 4: Distribution of participants based on groups.

		CLASS			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1st group	14	28.0	28.0	28.0
	2nd group	19	38.0	38.0	66.0
	3rd group	17	34.0	34.0	100.0
Total		50	100.0	100.0	

The reliability indicators for each interpersonal variable are provided in Table 5. It can be observed that all variables can be considered reliable.

Table 5: The reliability indicators of Wubbels' QTI in the presented research

8 categories of Wubbels	Items belonging to octane	Number of items	Cronbach-alfa
Admonishing (ADM)	4, 8, 12, 16, 20, 24	6	0,649
Dissatisfied, doubtful (DIS)	27, 31, 35, 39, 43, 47	6	0,683
Helpful, friendly (HFr)	25, 29, 33, 37, 41, 45	6	0,746
Leader (LEA)	1, 5, 9, 13, 17, 21	6	0,788
Student responsibility, freedom (SRE)	26, 30, 34, 38, 42, 46	6	0,712
Strict (STR)	28, 32, 36, 40, 44, 48	6	0,732
Uncertain, indecisive (UNC)	3, 7, 11, 15, 19, 23	6	0,714
Understanding, consensus-oriented (UND)	2, 6, 10, 14, 18, 22	6	0,754

In Table 6 we provided the descriptive statistical indicators of the eight interpersonal variables obtained during the research.

Table 6: Descriptive indicators of QTI variables

Categories of Wubbels	Mean	Standard deviation	95% confidence interval		(Skewness)	(Kurtosis)
			lower bound	upper bound		

Admonishing (ADM)	7,92	1,576	7,472	8,367	0,887	0,808
Dissatisfied, doubtful (DIS)	7,76	1,813	7,244	8,275	1,058	0,411
Helpful, friendly (HFr)	25,22	3,321	24,276	26,164	-0,727	03621
Leader (LEA)	23,52	3,078	22,645	24,395	-0,470	-0,498
Student responsibility, freedom (SRE)	17,70	3,333	16,752	18,647	0,873	0,513
Strict (STR)	11,94	3,588	10,920	12,959	0,067	-0,874
Uncertain, indecisive (UNC)	9,74	3,142	8,847	10,632	0,896	0,059
Understanding, consensus-oriented (UND)	27,08	2,320	26,420	27,739	-0,755	-0,258

The smallest possible value for the average is 6, while the highest is 30, as there were six items associated with each dimension, and the smallest assignable value on the Likert scale was 1, while the highest was 5. The teacher's attributes include helpfulness, a tendency toward consensus, and decisiveness; however, characteristics such as disciplinarian, sceptical, and indecisive are less typical. We are interested in the standard deviation in terms of individual differences, i.e., how much the obtained values vary within a given group. The higher the deviation, the greater the variation among the values obtained. In our case, the highest standard deviation is observed in the Strictness (STR) dimension (Figure 2), while the smallest is in the Admonishing (ADM) dimension (Figure 3).

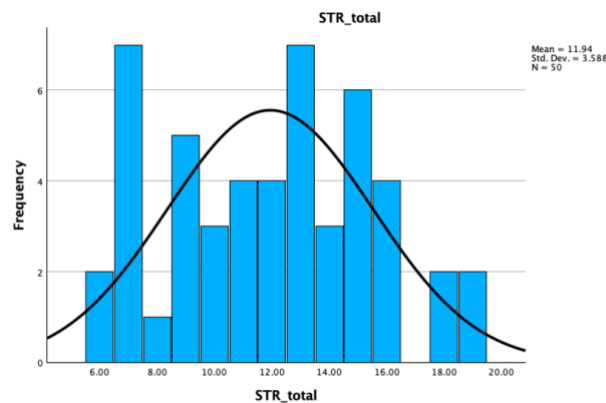


Fig. 2: Standard deviation of the STR dimension

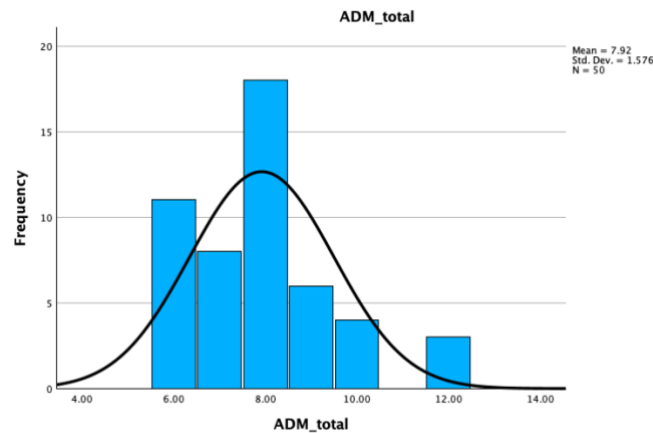


Fig. 3: Standard deviation of the ADM dimension

With the help of confidence intervals, we can see that there are dimensions where the values are shifted towards the lower bound, for example, in the ADM dimension, where the values fall between 7 and 9. There are also dimensions where the values are shifted towards the upper bound, for example, in the UND dimension, the values range between 26 and 28. Skewness indicates the direction in which a particular dimension is skewed. Kurtosis shows us how peaked the distribution is compared to a normal distribution. To assess this, we first applied the Kolmogorov-Smirnov test (Table 7). The normality test revealed that the distribution is not normal for 6 dimensions because the obtained values are less than 0.05, while in the case of 2 dimensions (Figure 4 and Figure 5), we can consider it a normal distribution (HFR: 0.053; STR: 0.200).

Table 7: The Kolmogorov-Smirnov test on 8 dimensions

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ADM_total	.220	50	<.001	.881	50	<.001
DIS_total	.182	50	<.001	.838	50	<.001
HFR_total	.124	50	.053	.933	50	.007
LEA_total	.153	50	.005	.951	50	.038
SRE_total	.175	50	<.001	.916	50	.002
STR_total	.096	50	.200*	.958	50	.076
UNC_total	.213	50	<.001	.890	50	<.001
UND_total	.194	50	<.001	.904	50	<.001

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

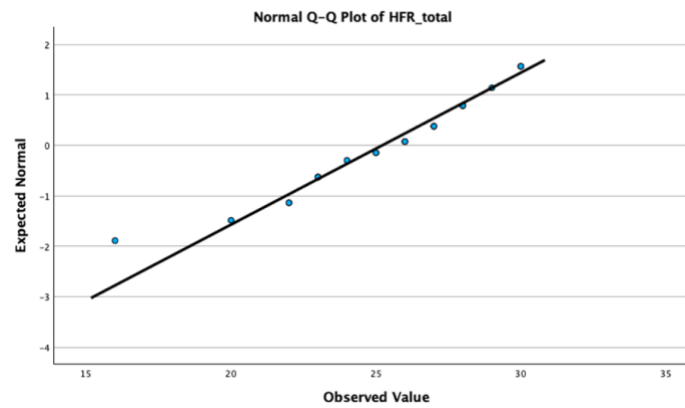


Figure 4: Normal distribution of the HFR dimension

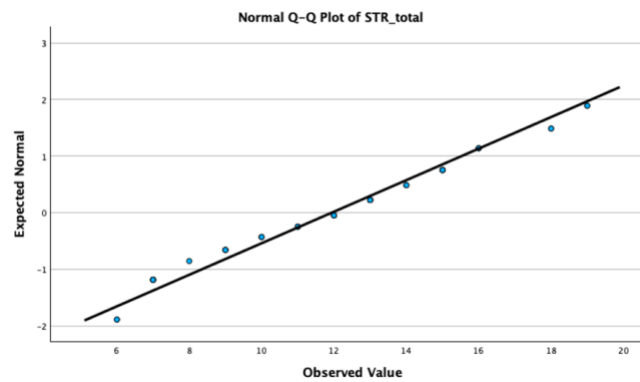


Fig. 5: Normal distribution of the ADM dimension

In the case of dimensions with a normal distribution (HFR and STR), we also conducted a homogeneity test, revealing that both the HFR ($0.676 > 0.05$) and STR ($0.264 > 0.05$) dimensions have homogeneous variances. Therefore, we can perform the ANOVA analysis for both dimensions (Table 8).

Table 8: Homogeneity test on the HFR and STR dimensions

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
HFR_total	Based on Mean	.177	1	48	.676
	Based on Median	.088	1	48	.768
	Based on Median and with adjusted df	.088	1	42.991	.769
	Based on trimmed mean	.159	1	48	.692
STR_total	Based on Mean	1.276	1	48	.264
	Based on Median	1.286	1	48	.262
	Based on Median and with adjusted df	1.286	1	47.216	.263
	Based on trimmed mean	1.250	1	48	.269

We wanted to find out if there was a significant difference between the responses of male and female respondents regarding the dimensions. For this purpose, we conducted the Mann-Whitney U test for 6 dimensions (excluding HFR and STR) (Table 9).

Table 9: Mann-Whitney test on 6 dimensions in terms of male/female background variables

Test Statistics^a						
	ADM_total	DIS_total	LEA_total	SRE_total	UNC_total	UND_total
Mann-Whitney U	249.000	250.000	291.000	258.500	222.500	250.000
Wilcoxon W	549.000	601.000	642.000	558.500	573.500	601.000
Z	-1.264	-1.237	-.411	-1.046	-1.755	-1.220
Asymp. Sig. (2-tailed)	.206	.216	.681	.296	.079	.223

a. Grouping Variable: GENDER

Since, for all 6 dimensions, the Asymp. Sig. is greater than 0.05, we can conclude that there is no significant difference between the responses of male and female respondents in the examined sample.

In the case of HFR and STR dimensions, we conducted ANOVA analysis (Table 10) to determine if there is a significant difference in the assessment between men and women. Since the Sig. for the HFR dimension (0.143) is greater than 0.05, we can conclude that there is no significant difference in the assessment between men and women in the examined sample. In the case of the STR dimension, the Sig. (0.023) is less than 0.05, so we can conclude that there is a significant difference in the assessment between the male and female respondents in the examined sample.

Table 10: ANOVA analysis in HFR and STR dimensions in terms of man/female variables

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
HFR_total	Between Groups	23.926	1	23.926	2.223	.143
	Within Groups	516.654	48	10.764		
	Total	540.580	49			
STR_total	Between Groups	64.810	1	64.810	5.496	.023
	Within Groups	566.010	48	11.792		
	Total	630.820	49			

The next step was to determine if there was a significant difference between the groups regarding the 8 dimensions. For this purpose, we conducted the Kruskal-Wallis test for 6 dimensions (Table 11), while for the HFR and STR dimensions, we performed an ANOVA analysis.

Table 11: Kruskal-Wallis test for 6 dimensions in terms of background variable of groups

Test Statistics ^{a,b}						
	ADM_total	DIS_total	LEA_total	SRE_total	UNC_total	UND_total
Kruskal-Wallis H	.953	.345	.955	7.520	2.544	.088
df	2	2	2	2	2	2
Asymp. Sig.	.621	.841	.620	.023	.280	.957

a. Kruskal Wallis Test

b. Grouping Variable: CLASS

In the ADM, DIS, LEA, UNC, and UND dimensions, there is no significant difference in the responses given by the three groups (>0.05). However, for the SRE dimension, there is a significant difference in the responses between the groups ($0.023 < 0.05$).

For the HFR and STR dimensions, an ANOVA analysis was conducted (Table 12) to determine if there is a significant difference in the assessments between the groups. Since the Sig. is greater than 0.05 for both dimensions, we can conclude that there is no significant difference in the responses between the groups in the two examined dimensions.

Table 12: ANOVA analysis in the HFR and STR dimensions in terms of background variable of groups

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
HFR_total	Between Groups	33.211	2	16.605	1.538	.225
	Within Groups	507.369	47	10.795		
	Total	540.580	49			
STR_total	Between Groups	17.253	2	8.627	.661	.521
	Within Groups	613.567	47	13.055		
	Total	630.820	49			

We can conclude that we found a significant difference only in two dimensions: in the STR (strict) dimension concerning gender and in the SRE (student responsibility, freedom) dimension concerning groups.

Regarding the STR dimension, we examined the responses of male and female respondents, broken down by groups (Table 13). We can see that the average of the responses received from male participants in the STR dimension is higher in all three groups compared to the average of responses given by female participants. However, due to the small sample size, this does not qualify as a significant difference within the group.

Table 13: Responses for the STR dimension in male and female groups

STR (strict)								
	female				male			
	Mean	Std. Deviation	95% conf. int.		Mean	Std. Deviation	95% conf. int.	
			lower bound	upper bound			lower bound	upper bound
Group 1	12,00	3,396	10,04	13,96	13,67	2,943	10,58	16,76
Group 2	11,26	2,921	9,85	12,67	12,50	2,798	10,50	14,50
Group 3	12,65	4,400	10,38	14,91	13,50	3,741	10,37	16,63

Regarding the SRE (student responsibility, freedom) dimension, there is a significant difference in the responses of the groups in the examined sample (Table 14).

Table 14: Responses for the SRE dimension in male and female groups

SRE (student responsibility, freedom)								
	female				male			
	Mean	Std. Deviation	95% conf. int.		Mean	Std. Deviation	95% conf. int.	
			lower bound	upper bound			lower bound	upper bound
Group 1	17,00	3,162	13,68	20,32	17,00	2,976	14,51	19,49
Group 2	16,60	2,796	14,60	18,60	16,44	2,127	14,81	18,08
Group 3	18,88	5,330	14,42	23,33	20,22	1,787	18,85	21,60

We also conducted the Scheffe test (Table 15) to examine if there is a significant difference in the responses between the three groups regarding the SRE dimension. With the help of the Scheffe test, we can see that out of the three possible pairings, there is a significant difference between the second and third groups (Sig. 0.018).

Table 15: The Scheffe test in the SRE dimension

Multiple Comparisons

Dependent Variable: SRE_total
Scheffe

(I) CLASS	(J) CLASS	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1st group	2nd group	.47368	1.09090	.910	-2.2840	3.2313
	3rd group	-2.58824	1.11779	.079	-5.4139	.2374
2nd group	1st group	-.47368	1.09090	.910	-3.2313	2.2840
	3rd group	-3.06192*	1.03400	.018	-5.6757	-.4481
3rd group	1st group	2.58824	1.11779	.079	-.2374	5.4139
	2nd group	3.06192*	1.03400	.018	.4481	5.6757

*. The mean difference is significant at the 0.05 level.

Based on these findings, we can conclude that there is a significant difference in the examined sample for only two dimensions: the STR (strict) dimension concerning gender and the SRE (student responsibility, freedom) dimension concerning groups. In Table 16, the descriptive statistical indicators of the QTI variables are displayed according to background variables.

Table 16: Statistical indicators of the QTI variables based on background variables

A Wubbels-féle nyolc kategória	Gender				Groups					
	Male		Female		1st group		2nd group		3rd group	
	95% conf. int.		95% conf. int.		95% conf. int.		95% conf. int.		95% conf. int.	
	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound	lower bound	upper bound
Admonishing (ADM)	7,01	8,56	7,50	8,56	7,21	9,50	7,00	8,04	7,14	8,85
Dissatisfied, doubtful (DIS)	7,26	8,89	6,78	8,13	6,74	8,68	6,74	8,51	6,92	8,96
Helpful, friendly (HFr)	23,00	25,99	24,66	27,10	23,53	27,17	22,69	25,83	24,42	27,93
Leader (LEA)	22,33	25,00	22,14	24,62	22,27	26,15	21,92	24,70	21,55	24,79
Student responsibility, freedom (SRE)	15,82	19,09	16,78	19,05	15,30	18,69	15,35	17,70	17,62	21,54
Strict (STR)	11,82	14,42	9,34	12,35	10,03	13,96	9,85	12,67	10,38	14,90
Uncertain, indecisive (UNC)	9,09	11,98	7,90	10,09	7,10	10,46	8,56	11,96	8,47	11,41
Understanding, consensus-oriented (UND)	26,41	28,41	25,85	27,68	26,46	28,25	25,28	27,97	26,16	28,54

5 Answers to the Research Questions

In this study, we aimed at answering three research questions. The first research question (Q1) was as follows: How can we characterize the interaction style and interpersonal behavior of an English teacher at a Hungarian university from the perspective of English-major students? We measured the teacher's interaction style using a questionnaire that examined eight dimensions of the teacher's interaction style. In the study, a total of 50 students from three groups participated. In the examined sample, the lowest score was in the DIS dimension, indicating the "dissatisfied, skeptical" dimension. The highest score was in the UND dimension, representing the "understanding, consensus-seeking" dimension. Based on this, we can conclude that in the examined sample, students perceived the teacher as understanding, consensus-seeking, helpful, and friendly. According to the students, the teacher is not scolding, uncertain, or indecisive. The examined eight dimensions were ranked

as follows (from left to right, indicating increasingly characteristic personality traits of the teacher): DIS (7.76); ADM (7.92); UNC (9.74); STR (11.94); SRE (17.70); LEA (23.52); HFr (25.22); UND (27.08).

The second research question (Q2) was as follows: Considering the background variables, what differences emerge in the evaluation of the teacher among different student groups? Both for male and female respondents, it was found that in 7 dimensions there is no difference, but in one dimension (STR: strict), there is a significant difference in the evaluation between men and women respondents. Concerning the groups, it was concluded that in 7 dimensions there is no difference, but in one dimension (SRE: student responsibility, freedom), there is a significant difference in the responses between the groups.

The third research question (Q3) was: Does the evaluation of the teacher's interaction style by students in the examined sample align with the characteristics of the interpersonal behavior considered ideal by teacher trainees? Tóth & Horváth (2022, 126) measured the attitude of teacher trainees toward the ideal interpersonal behavior in a previous study. They concluded that "according to teacher trainees in the Carpathian Basin, the ideal teacher interactions are characterized by high levels of directive, assertive, helpful, friendly, and understanding, consensus-seeking attitudes, while low values characterize uncertain, indecisive, dissatisfied, skeptical, and admonitory, warning attitudes."⁴

Therefore, the ideal interpersonal behavior of teacher students is characterized by high values of the following attitudes: leader, assertive (LEA), helpful, friendly (HFr), understanding, and consensus-seeking (UND). Additionally, low values characterize attitudes of uncertainty, indecisiveness (UNC), dissatisfaction, skepticism (DIS), and admonitory warning (ADM).

In the current research, the examined sample displayed low values in the DIS, ADM, and UNC attitudes, while showing high values in the LEA, HFr, and UND attitudes. The attitudes marked with low values in our study align with the attitudes that received low scores in the ideal interpersonal behavior according to teacher students, as measured by Tóth & Horváth (2022), regardless of the order (UNC, DIS, ADM). Similarly, attitudes receiving high scores (LEA, HFr, and UND) also show consistency between the examined sample and the characteristics of interpersonal behavior considered ideal by teacher students. Based on this, we can conclude that in the examined sample, the interaction style evaluated by the students aligns with the characteristics of the interpersonal behavior considered ideal by teacher trainees.

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⁴ Trans. by LDSZ.

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Education of Future Entrepreneurs

István Szőköl¹, Ondrej Kováč²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1261>

Abstract

The article deals with connecting theory with practice in the school environment. Schools are able to create, to a certain extent, an environment that resembles the real working environment in companies within the subject. It could be, for example, a vocational subject that is focused on the field of production and business. That subject can work if we establish quality conditions that are important for running the business. Ensuring suitable work equipment, technique, and technology, educated staff and suitable working conditions is essential. Certain factors influence each work environment, job position and function. They should also be part of the summary of topics for this subject. The article describes the essence of the accurate functioning of the class aimed at linking theory with production and business activities. The primary technical and economic knowledge of pupils is essential as well. That knowledge is the basis for the creation of realistic goals and their realisation within the exercise of entrepreneurial activity.

Keywords: Production, technology, Enterprise, Business, Economy, Education

1 Introduction

Schools and other educational institutions are constantly educating new graduates who are trying to gain an edge in their professional and personal lives with the help of the acquired knowledge. Some former students become successful employees in various companies or the state sector, while others start businesses and employ other graduates. Businesses and entrepreneurs are an important element of the national economy. They produce products, provide services, create jobs, etc. Being an entrepreneur can be tempting for young people, but they also must reckon with various difficulties. The desired result does not always appear as it is expected. However, one must be positive in one's thoughts and not lose optimism. Creativity, flexibility, communication, imagination, and many other qualities are prerequisites for a successful business. Various internal and external factors can play a significant role in influencing success in business life. To secure the necessary financial resources, create a

¹ Trnava University, Faculty of Education, Department of School Education, Priemyselná 4, 918 43 Trnava.

E-mail: istvan.szokol@truni.sk

² DTI University, Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovakia.

E-mail: kovac@spskn.sk

suitable technical and personnel background, assert oneself in the competitive struggle with other companies, and adapt to various rules, laws, and economic situations. When a future young entrepreneur has sufficient motivation, knows how to set realistic goals, and has the strength to work hard, he should be given a chance. School is a suitable tool for preparing students for business life. It creates space for acquiring theoretical and practical knowledge and connecting theory with practice.

2 Schools and Enterprises

The business sphere plays a vital role in the country's economy. Businesses produce products, provide services, and create many jobs. From the smallest with a few employees to the largest, they are an essential part of the economy. Every business needs sufficient technical, technological, financial and personnel security for quality functioning. The production enterprise must have various machines, equipment, devices, computer technology, production materials, parts, etc., in the required quality and quantity. All this must be obtained from financial sources, where help can be requested from the state in the form of subsidies or from banks in the form of loans. It needs educated personnel for procurement, production, promotional and administrative activities. It is precisely in the field of providing educated personnel that schools have an important role, namely, schools deliver qualified graduates full of expectations and energy. Schools offer their students the necessary knowledge and practical skills and, thanks to this, prepare them sufficiently for the labour market. The summary of various teaching subjects creates a link between the individual components of comprehensive education (Ugrai, 2020).

What is a business activity? Holková (2020) describes entrepreneurship as a set of activities for searching and implementing economic opportunities. Entrepreneurship is an economic activity that aims to find and effectively use business opportunities on the market.

How can we educate many future great entrepreneurs in a school environment? First, we need teachers who can create the necessary knowledge base in students and then follow up with additional knowledge related to practice. It does not matter what kind of approach the teacher has to his students when imparting knowledge, explaining, testing, and evaluating. When a teacher can attract attention with his creativity, expertise, and humanity, he creates sufficient motivation for students to be interested in learning.

What qualities must a teacher have to be interesting enough for students? Every student is different; everyone has their own world of views on life, society, and priorities. When there are 15 to 30 students in a class/group with different character traits, abilities, interests, and different personal and work goals, it is a difficult task for the teacher to create such an environment and climate in the classroom where each student is an active part of the lesson. A teacher needs high-quality communication skills, appropriate rhetoric, the ability to explain, to direct attention, to respond flexibly to student questions, to motivate, and to be a role model from a professional but also a human side.

Business activity and management of the company itself have extensive rules. Not everyone can be a successful entrepreneur. A person must have such qualities that create a perspective in business life. He must be able to react flexibly and effectively to various situations so as not to be frightened in the event of sudden and unexpected changes that are part of business life. To a certain extent, he must anticipate both risks and opportunities, appropriately deal with various situations, adapt to new trends, communicate convincingly, and maintain quality and fair relations with business partners. The school will provide the necessary knowledge through various teaching subjects, which are connected in such a way as to achieve the gradual professional development of the student from the theoretical and practical side. They are mainly the following subjects: economics, administration, accounting, human resources management, marketing, and management. Each subject adds essential components to a comprehensive perception and understanding of business activity.

3 Important Fields and Subjects

The field of economics is essential for students to understand the functioning of the economy. Economics, as a subject, deals with various areas that are necessary for business activity.

They are, for example:

- enterprises and their division according to the subject of activities and the number of employees,
- markets and their division,
- competition and its breakdown,
- banks and their functioning, loans, interest,
- finances, budget, costs, revenues,
- insurance companies and their activities, types of insurance,
- tax system.

Administration also plays an important role. A summary of various documents, business documents and other documents is an integral part of the functioning of any business. They are, for example:

- documents during supply activities, during storage,
- documents in sales relations,
- employment documents,
- various contracts,
- communication between companies, suppliers, and customers,
- communication with the bank, insurance company, various institutions, and authorities.

Accounting keeping creates the basis for the operation and control of the business. It provides an overview of essential indicators, the company's financial situation, assets, receivables, liabilities, etc.

HR (human resources management) is responsible for the company's employees' quality, quantity, and structure. It is mainly in charge of the following areas related to employees (workers):

- determining and describing the workplace, determining the number and structure of employees,
- search, acquisition, selection, and acceptance,
- working conditions, working environment, employment contract,
- adaptation, training, qualification, and retraining,
- development and career growth,
- motivation and control,
- evaluation and remuneration.

Marketing includes various activities that create customer interest in new products. The products then get from the producer to the consumer. These activities are mainly:

- market surveys, obtaining information about what customers need,
- searching and contacting business partners,
- determining product prices based on the market, interest in products, production, and sales costs,
- product advertising, addressing customers, creating a positive opinion about the offered products,
- distribution and actual sale of products.

Management represents the background of management activities for the smooth running of the company. He looks for optimal strategies and deals with planning, organizing, decision-making, coordination, and control. Monitors the company's operation, tries to eliminate shortcomings, and strengthens possible weaknesses of the company (Szókö, 2017).

In addition to the mentioned areas, students must acquire knowledge in technical and informatics as well.

- work safety, instructions, and instructions,
- working with a computer, various software for planning and modelling products,
- production technology, procedures of production activities,
- machines, devices, their functioning, and control,
- production materials, components, and technological materials.

4 We Learn to Do Business

The connection of theoretical knowledge from the mentioned subjects with practice can be ensured by a subject that deals with business activity. Pupils will gradually become familiar

with the business, its benefits, and its advantages. In this subject, students create groups that symbolise businesses. It is a playful form of business where students behave and think like entrepreneurs. Of course, this is not a proper business. It is only a game in groups, where they can use their theoretical knowledge and gain new practical experience.

In this subject, the importance of cooperative teaching will also be shown.

4.1 Work in Groups, Cooperative Teaching

Turek (2014) describes the essence of cooperative teaching as the work of students in small groups, where students work together in an atmosphere of equality, solve various tasks, perform certain practical activities, etc. For the lesson in cooperative teaching to be effective, the teacher should respect some requirements. Positive interdependence of students in the given group should be ensured, which means that students solve assigned tasks together and are rewarded for the results. In a group, they depend on each other to work. Pupils should work in such a way that they have mutual contact (Pavlov, 2018). Appropriate arrangement of benches and chairs also helps in this. Each group member should be involved in the work so that it does not happen that someone looks on and does nothing for the benefit of the group. Each student must take personal responsibility and work for the group. Pupils should also improve their communication skills, while non-verbal communication is also essential. Pupils must be guided in their work in such a way that the specified goals are achieved, that they do not have fun in class at the expense of teaching, and that the relationships between group members are correct and effective. The optimal number of students in a group is four to five (Turek, 2014, pp. 376 - 377).

For a subject focused on business activity, we need to determine specific goals and then follow up with a precise breakdown of topics. Gradually, the students become familiar with the process of establishing a company, set goals, and create creative ideas. Based on goals and ideas, they create a business plan and prepare the necessary official documents. In this way, step by step, they prepare the basis for the successful operation of the company. It is essential that students acquire skills and gain experience that are important in business activity and business management. For the business to function effectively, it is necessary to have hard-working, responsible, and high-quality partners (classmates). When one of the group members is lazy or less hardworking, other members must work instead of him, which causes conflict situations and negatively affects the company's operation (Porubčanová, 2018).

The teacher approaches each "student enterprise" individually and collectively. Basic instructions regarding establishing a business, working with documentation, etc. are collective and concern all groups. In some areas, however, the teacher approaches the groups individually.

These are mainly the following phases of activities:

- description of the subject of the activity, production program,

- setting the company's goals and ways of achieving them,
- determination of business opportunities and risks,
- distribution of functions, tasks, and competences,
- market research on what would be interested in a real business,
- searching for suppliers of parts via the Internet,
- design and production of product prototypes (manually and with the help of machines and computer technology),
 - distribution of manual work in the production of products,
 - production activity,
 - presentation of finished products,
 - creating promotional materials, posters, and catalogues,
 - summarisation of the achieved goals (Szókö, 2016).

In the mentioned activities, the teacher must approach the students in such a way as to help them develop creativity and, at the same time, let them work independently as one cohesive group. The cooperative activity of pupils in entrepreneurial activity greatly influences the level of achieved goals and the result of the business. By dividing the competencies among the students, knowing who should do what and what they are responsible for, a high degree of efficiency, controllability and transparency is guaranteed. Individual activities follow each other. Therefore, problem-free communication and cooperation of students is essential. The students' work can be affected by some problems or situations that need to be solved gradually (Marks-Lajčin, 2017).

They are the following:

- some students in the group does not work, does not fulfil his tasks and duties,
- pupils have different opinions, disagreements will arise between pupils,
- some students is often absent from class, and thus his work must be divided among the other members,
 - production materials and parts are unavailable or very expensive,
 - various technical problems occur during supply and production,
 - many failures will be created,
 - the group cannot meet partial goals,
 - other negative external factors emerge.

There should also be healthy competition between each single student companies. Their goal is to arouse interest in the products, to produce several high-quality products and to present the achieved results. Groups are compared at the end of the school year according to various criteria, such as rate of achieved goals, customer satisfaction, quantity of manufactured products, etc. The teacher evaluates all groups, highlights their successes and positives, and draws their attention to possible shortcomings.

4.2 Pupils' Work in the Lessons

Pupils' work in the lessons of this subject can be divided into certain blocks. Pupils form groups of 4 to 6 members based on their or the teacher's choice. They will determine the name of the company, the subject of the activity and the production program. They will agree on what they will deal with as part of the business. They will discuss the benefits of doing business in the chosen field, the possible risks, and the necessary theoretical knowledge for starting a business. They set business goals and look for ways to achieve those goals. They divide functions and tasks so that it is clear in advance who will oversee what and for whom they will be responsible. Based on the divided functions, they will create an organisational structure (Marks-Lajčín, 2016).

Establishing a business also has an administrative side, so they prepare various documents related to the start of the business. They will create a logo and determine the primary data of the company. Using various methods (brainstorming, brainwriting), they collect many ideas related to the subject of business activity. Ideas create new products they would like to produce and can realistically produce. They choose 8 to 10 of them, which can be implemented in the school environment. All proposed products will be described in terms of design (shape, size, colour...), composition (material, parts, components, packaging...) and production process (Hrmo, Turek, 2003).

Creating new ideas has a certain priority. A beginner entrepreneur without new ideas and thoughts does not have much chance to establish himself in the market. New ideas must come from all members of the group. Then, the brainstorming method is created.

Petlák (2000) sees the importance of brainstorming in that it contributes to the humanisation of teaching and increases the creativity of pupils. Each student expresses his opinion on a given question, issue, or subject. The other pupils are also active, listening, and comparing.

Brainstorming and brainwriting are suitable methods for innovative ideas. Holman (2005) identified innovation as the most important business activity because innovation expresses the activity of introducing a new product to the market. The entrepreneur finds out what people need and what they are willing to pay for.

Pupils need to find out which products would be of sufficient interest and which products would be interesting for the circle of possible customers. Therefore, they prepare a questionnaire about the proposed products and distribute them to obtain a lot of information. They will then evaluate the questionnaires and decide what they will produce based on the data obtained. They specify the production program and draw up a production plan (Bendíková, 2014).

They draw the proposed products using computer programs. They will design the necessary technical background of the production (machines, devices, tools, protective equipment, etc.), the technology, and the exact production procedure. They search for suppliers of materials and parts and compare purchase prices. They select suitable suppliers and procure materials and parts to produce prototypes.

Strážovská et al. (2005) describe the optimisation, control of the purchasing process and the creation of stable business relationships as an important role of supply.

Therefore, even students must objectively determine the need for supplies before purchasing, consider price and quality factors and make decisions based on this.

The school covers all costs related to the procurement of materials and energy consumption. In this case, the school "represents the state", which will support young entrepreneurs. Pupils make prototypes of products that they check and test to see if they meet the necessary parameters, functionality, and aesthetic criteria. If deficiencies are found, they will propose changes and corrective procedures.

Flyers are a suitable and cheap way of advertising. Zamazalová (2009) spoke about flyers as a printed form of advertising, with the help of which we try to reach as many customers as possible with various attractive offers and arouse their interest in visiting our store.

Pupils will create advertising materials (mainly flyers) and distribute them in school to increase interest in the planned products. Since this is not a real business, they will not sell the products. They will give them out in limited quantities to potential interested parties. Interested parties can also order products with individual requirements for design, colour, and other aesthetic appearances (Kissné, 2021).

Based on the respondents' opinions in the questionnaire and orders and interest in the products, the students determine the scope of production and plan the number of manufactured products.

The production activity can be divided into different spaces (classrooms) based on what will be done, what technology the students will choose, what technical equipment they need, etc. Work activities involve machine tools and other equipment, while computer technology or manual work is used elsewhere. During production, e.g., can be used. CNC technology, 3D printer, laser engraver. The products also go through finishing work, where their aesthetic appearance is adjusted, and they get their final form.

It can be produced even without the help of technical equipment. Many products can be made by hand. In this case, manual work, such as cutting, glueing, colouring, painting, and assembly, comes to the fore. Finished products can be wrapped in packaging material. The packaging provides not only a better appearance of the products, but also protection against damage, information on the composition and advertising.

After the end of the production, the students present their finished products. With the help of pictures and videos they made during the individual activities, they will explain the entire procedure from the company's establishment to the production activity. They compare the goals with the achieved results, explain and justify any shortcomings. The presentation concerns all groups. They can be compared to each other based on production volume, interest in their products, achieved goals, etc. They distribute the ordered and manufactured products to customers, ask them about their opinion on the products, and collect data on satisfaction, e.g., also using another questionnaire.

What is the teacher's job on such a subject? Students must already have theoretical knowledge before being "participants" in this subject. The teacher repeats the essence of businesses and entrepreneurship and emphasizes requirements and rules. He monitors, coordinates and partially even directs the pupils at work. In case of loss of motivation due to various unpredictable problems, the teacher is the source of energy and strength. He tries to guide the students so that the goals of the company are achieved. Pupils ask the teacher and sometimes solve situations together, which also needs certain experience.

Conclusion

The success of teaching subjects can be evaluated over time. Sometimes, you must look for something new, interesting, and more effective, but do not forget what has worked until now. Schools try to innovate the range of teaching topics based on the demands of society and the labour market. Teachers must respond flexibly to new topics, subjects and choose appropriate teaching methods to achieve the desired effect. Pupils must be prepared so that their knowledge and skills are at employers' desired level.

Acknowledgements

The following project supported this contribution: grant KEGA No. 001TTU-4/2023 *"The development of language competences supporting the language education of future primary school teachers in schools with Hungarian as the language of instruction"*.

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Material Didactic Means in the Educational Process

István Szököl¹, Miroslav Osifčín²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1262>

Abstract

Material didactic means (technical means and teaching aids) are means of a material nature and are an essential component of education and a means of achieving the goals of the educational process and are part of Engineering Pedagogy. They serve to achieve educational goals. They are part of didactic resources. A technical means as a material means that creates the conditions for delivering the prescribed curriculum to students. He is only an intermediary who performs a secondary function concerning the content of education. Didactic means are divided into didactic technique and didactic content. The didactic technique is a set of technical means. In our research, we focused on the content of the processed innovative professional text for engineering technology in dual technical education as an effective support for teachers. The result is the evaluation of the processed professional text for the subject of mechanical technology through the Close test. The results showed that the text is readable and manageable for the specified group of students.

Keywords: Material didactic means, Technical devices, Teaching aids, Professional text

1 Introduction

Material didactic means are means of a material nature and are an essential component of education. They serve as a means to achieve educational goals. They are part of didactic resources. Before we start thinking about creating and choosing a method of inclusion in the classroom, we need to know the content of the education for which it is intended. The main criteria for the selection of didactic means are the goal pursued, the content of the teaching, the nature of the phenomena demonstrated, the age, level, level of education of the students, the purpose of the teaching and the level of the teacher and his ability to use the intended didactic means.

¹ Trnava University, Faculty of Education, Department of School Education, Priemysel'ná 4, 918 43 Trnava.

E-mail: istvan.szokol@truni.sk

² DTI University, Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovakia.

E-mail: miroslav.osifcin@minedu.sk

According to Pavlov (2018), the term "material didactic means" narrows the class of didactic means to material carriers of information, to technical devices and equipment of schools and classes that serve educational purposes. Didactic aids accompany teaching since the beginning of cultural history, e.g. when familiarising with objects and phenomena when using tools, etc. Here, it is also possible to consider them a drawing in the sand. From a developmental point of view, several generations of aids can be distinguished:

- specific subjects and phenomena functionally used in education,
- pre-machine tools (e.g. sketch, picture, real models),
- tools associated with the invention of printing (printed materials, books),
- means that improves human senses (binoculars, microscope, film, etc.),
- a device enabling human-machine communication (computer, Internet).

Didactic means are divided into didactic technique and didactic content. The didactic technique is a set of technical means. The didactic content is a set of signals with the subject matter. Teaching depends mainly on the quality of didactic content. Even the best-prepared teacher cannot apply the didactic technique unless he has high-quality didactic content. Integrated didactic workplaces are part of the material didactic resources.

2 Material Didactic Means

The tool serves to achieve educational goals. It complements the word of the teacher, which is a very powerful argumentative tool. The term material-didactic means narrows the class of didactic means to material carriers of information, to technical devices and equipment of schools and classes that serve educational purposes (Porubčanová, 2018).

Didactic tools have an irreplaceable place in the educational process. They became necessary not only in the work of a teacher but also in the work of a student. The results of use depend not only on the teacher's technical level and ability but especially on the level of didactic content (Ugrai, 2020).

Didactic means (Fig. 1) are material or immaterial according to their nature.

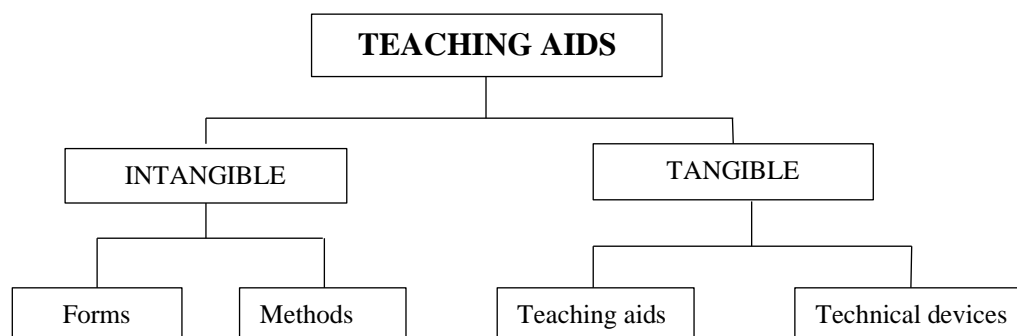


Figure 1: Didactic (teaching) aids (Hrmo-Turek, 2003)

Part of the teaching aids are non-material, among which we classify forms and methods. These ensure the professional component, while the teaching methods are focused on the thought process of the teacher and the student; on the other hand, the forms ensure the teaching-educational process, i.e. the external side. Organisational forms of teaching are most often divided according to the number of students participating in the teaching process together with the teacher (individual, collective and mixed), the place of implementation of the teaching process (school and extra-curricular) and the degree of independence of students' work in the teaching process (individual work of students, group work of students and students' frontal work).

We understand the methods of the teaching process as a deliberate arrangement of the curriculum and activities of the teacher and students, which are aimed at achieving the goals of the teaching process while respecting didactic principles (Hrmo-Turek, 2003).

Material didactic means are a means of achieving the goals of the educational process and are part of Engineering Pedagogy. According to Szókö (2015), engineering pedagogy is a frontier scientific discipline that transforms the knowledge of pedagogy and psychology into technical sciences. Its purpose is to increase the didactic effectiveness of engineering education. They include teaching aids and technical means, which inseparably include integrated didactic workplaces. Better results are achieved in the educational process, which means that knowing and acquiring knowledge has a multi-sensory and multi-code character.

Hrmo and Turek (2003) define a technical resource as a material resource that creates conditions for the delivery of the prescribed curriculum to students. He is only an intermediary who performs a secondary function in relation to the content of education.

Hrmo and Turek (2003) define a teaching aid as a material means that is a direct carrier of information and can provide content directly (e.g. a model) or through a technical means (e.g. a data projector).

Material teaching aids can be shown in a few numbers and the fact that the average person remembers approximately 10% of what he reads, 20% of what he hears, 30% of what he sees in the form of an image, 50% of what he sees and at the same time hears, 70% of what he sees, hears and actively performs at the same time, 90% of what he has arrived at on the basis of his own experience by performing the activity (Marks, Lajcin, 2017).

"Didactic means, as a category of didactics, all material objects that ensure, condition, and make the course of the teaching process more efficient. These are subjects that, in close connection with the teaching method and organisational form, help to achieve educational goals" (Marks, Lajcin, 2016).

We must know and respect certain requirements for the selection, creation, use and appropriate inclusion of teaching aids in the teaching process. Such requirements are didactic, ergonomic, aesthetic, technical, and economic. We must also consider the functions and requirements placed on material teaching aids. Bilčík (2018) lists informational, transformational, activation and regulatory functions among the basic functions of material teaching aids.

Material teaching aids are teaching aids and those technical aids that perform didactic functions (Hrmo & Turek, 2003).

2.1 Technical Devices

According to pic. 2, technical devices are described as basic equipment, auxiliary equipment, technical aids and machines and devices. Appropriate equipment of the school with technical equipment is an essential condition for ensuring the quality of the educational process. Here, there must be harmony and agreement between the school management and the school's teaching staff. In primary and secondary schools, they are teachers, and in secondary vocational schools, in addition to teachers, there are also masters of expert training.

Basic facilities include classrooms, specialist classrooms, language classrooms, laboratories, school workshops, etc. Kindergarten students' classrooms are basic classrooms for the educational process, where, as a rule, some re-educational subjects are taught or when the capacity of expert options is insufficient, and their equipment is basic school furniture, among which we include school desks, chairs, teacher's desk and a green or whiteboard, or their combination. In addition to the mentioned equipment, if the schools have the funds, the classrooms are additionally equipped with a PC, a data projector, a projection screen and possibly speakers. The technical aids include, according to pic. 2 display surfaces, projection surfaces, projection technology, sound technology, television technology and video technology, teaching machines, computers and multimedia resources. We also call this group of aids didactic technique.

Technical aids (Fig. 2) are such material didactic aids that create the conditions for passing on the prescribed curriculum to students. They are only an intermediary that performs a secondary function in relation to the content of education, e.g. a data projector with a PC that projects a didactic video. For auxiliary equipment, we recommend heating, cooling, air conditioning, darkening, electrical distribution, water supply, etc. Teaching machines also belong to the group of technical aids. They can download learning information according to the embedded program. Furthermore, they can assign tasks for practice, repetition, to consolidate the learning material, evaluate the achieved knowledge and manage the learning with the help of feedback. We recommend informants, examiners, repeaters, trainers and combined types for teaching machines. We use the tools Macromedia Director, Macromedia Flash, Microsoft FrontPage, Macromedia Dreamweaver... to create multimedia applications. Didactic machines and equipment, devices and gauges include those that we use for didactic purposes.

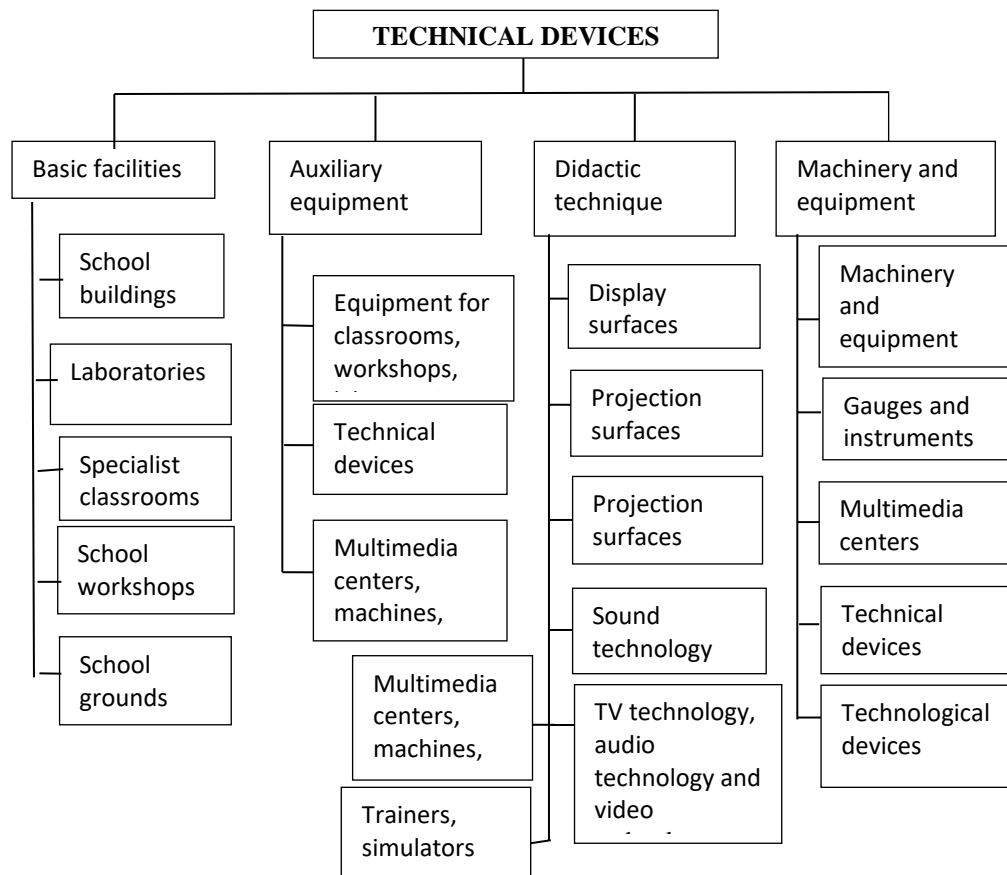


Figure 2: Technical devices (Szököl, 2016)

As a rule, special classrooms are equipped with instruments and measures. The equipment of special classrooms is usually extended by machining and forming machines, welding aggregates or their combination in-school workshops. There are secondary schools that have classrooms equipped with machines and devices.

2.3 Teaching Aids

According to Zsámbokiné (2021), teaching aids are those aids that enable the observation of real objects. According to Driensky and Hrmo (2009), we divide teaching aids into auditory, visual, audiovisual and cybernetic (Fig. 3). The way they are made depends on the function (information, transformation, activation, regulation, etc.) and the task in teaching (motivational, application, demonstration, simulation, descriptive, repetition, examination, etc.).

Švejda et al. (2018) were based on the original division according to fig. 3 and expanded the teaching aids by three more categories. Thus, in addition to auditory, visual, audiovisual, cybernetic, they describe listening machines, hypermedia and multimedia, and special MDP.

This topic is also addressed by Bendíková (2020) in the article Reflections on the Use of Interactive Whiteboards in Instruction in International Context. If we want to achieve the best

possible didactic effectiveness, we need to know in what form we will make the curriculum accessible using a teaching aid. When preparing it, it is necessary to take into account the educational goal, forms and methods, the subject, its nature and the focus of the material covered, the target group, the level of knowledge, skills and experience of the participants, the type and level of education of the target group.

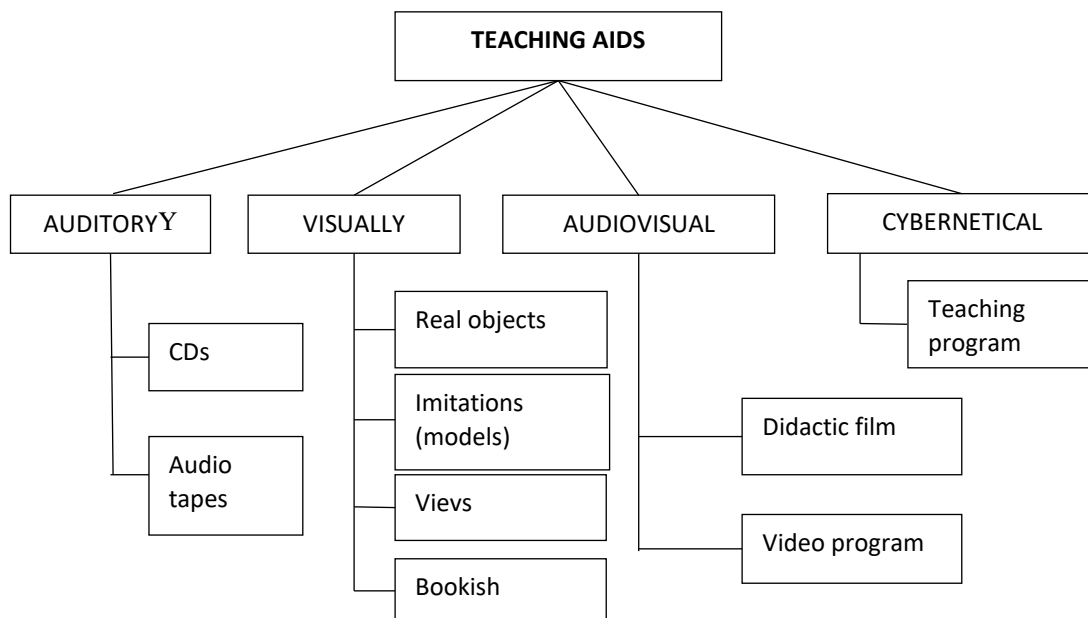


Figure 3: Teaching aids (Hrmo-Turek, 2003)

Průcha (2009) states that the most essential part of material didactic (teaching) means are teaching aids; their function is immediate participation in the teaching process. Their optimal action results from the position they have in the system of structural bonds, as shown in Figure 4.

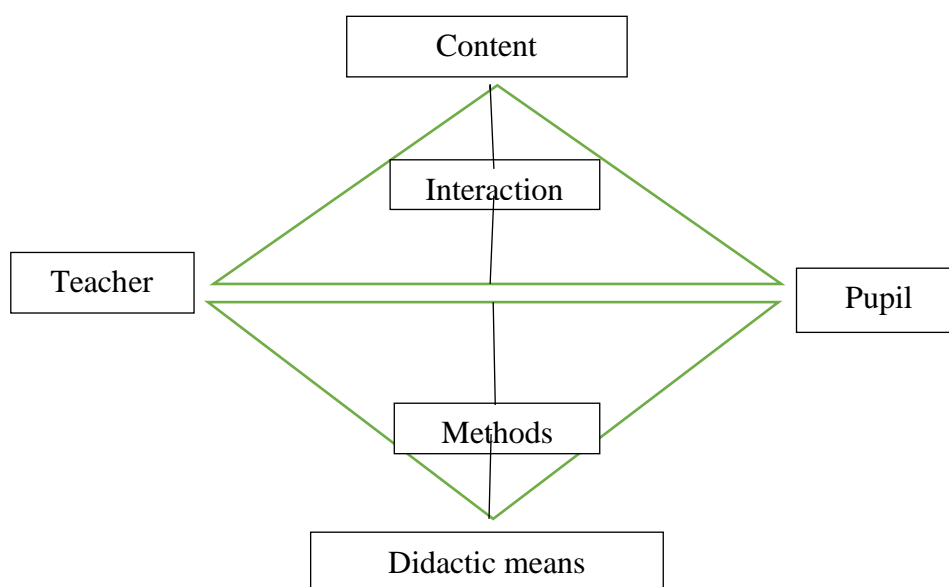


Figure 4: The structure of the teaching process (Průcha, 2009)

Figure 4 follows the traditional didactic triangle supplemented by an element of didactic means. Here, we distinguish the quality between bindings.

From a historical point of view, several generations of teaching aids can be distinguished:

- specific subjects and phenomena functionally used in education,
- pre-machine aids (sketch, picture, model),
- tools associated with the invention of printing (books, printed sheets),
- means that it makes human senses more effective (binoculars, microscope, film),
- a device enabling human-machine communication (PC, Internet).

Just as we must learn to express words accurately, it is necessary to learn to read images, i.e., understand their information. We distinguish several levels of reading images (Bilčík, 2018):

- stage of enumeration, calculation,
- descriptive stage,
- stage of thought processing.

According to this, it is important that students are led to critical thinking and that they learn to co-create images, e.g. take notes and picture notes. Teaching aids have differences among themselves. We can assess them mainly according to the fulfilment of economic and material-technical requirements for production and mainly according to the didactic function.

Teaching aids as carriers of didactic information are the bearer of the goal-content-method and are a teaching management tool in that:

- they make the curriculum available to the student through various means of communication:
- how the sources lead the student to the active acquisition of knowledge, subject matter and preparation for practice,
- they provide space for the development of the student's abilities, interests and the creation of attitudes,
- they intensify, rationalise, and make the work of both teacher and student more effective.

According to Fig. 3 teaching aids are auditory, visual, audiovisual, and cybernetic. Part of the visual o. i. They are also bookish.

3 Professional Text for the Selected Chapter on the Subject of Mechanical Technology

Engineering technology is one of the basic subjects of engineering departments and follows the subjects of mathematics, physics, chemistry, technical drawing, mechanics, and electrical engineering.

Based on the ŠkVP, which is part of the "ŠVP Strojárstvo" 23, 24 Engineering and other metalworking production, we prepared professional teaching texts for the subject of Mechanical Technologist. This subject is taught in all years in the school educational program 2381 M - mechanical engineering at the secondary industrial school. The processed didactic

text is part of the seventh thematic unit: Turning in the 1st year of study. The subject aims for the student to acquire the target knowledge and skills after taking over the individual thematic units.

The graduate should know the basic technical terminology for engineering and other metalworking production, the basic types of materials and semi-finished products used in engineering, their production process, the methods of heat treatment and surface treatment of materials, and know the basic technological procedures of manual and machine processing, machining, forming, casting, welding, assembly and functional tests of engineering semi-finished products and products.

After studying the teaching text, the student should know:

- characterise turning,
- list the essential turning knives,
- name the basic types of lathes,
- describe the universal point lathe,
- determine typical turning jobs,
- prescribe the accuracy and surface quality achievable by turning,
- determine the cutting conditions of turning.

We have prepared the teaching text into four chapters. After studying the thematic unit, the student should know:

- characterise turning,
- list the basic turning knives,
- name the basic types of lathes,
- describe the universal point lathe,
- determine typical turning jobs,
- prescribe the accuracy and surface quality achievable by turning,
- determine the cutting conditions of turning.

4 Pedagogical experiment

Vargová (2014 in Porubčanová, 2018) states that the quality of technical education in schools can be supported by using modern, innovative concepts of the teaching process. Innovation is generally understood as "a new phenomenon, a new idea, a new product". Innovation concerning education is "the introduction of something new, new methods, new forms in teaching, the introduction of new teaching aids and means". The quality of education also depends on the school's equipment with teaching aids. Ugrai (2020) stated that appropriate material and technical equipment is the result of cooperation of their management with teachers and masters of professional training. When there is a lack of cooperation from teachers and masters of professional training towards management, it may not result in deficiencies in equipment; the opposite case leads to the emergence of negative phenomena at school.

Hypotheses and methodology of the experiment: The main goal of the pedagogical experiment is to process and evaluate a professional text on selected thematic units in the subject of mechanical technology, which will be manageable in the 1st year of the school educational program 2381 M - mechanical engineering at a secondary industrial school.

Sub-goals: In order to fulfil the main objective of the research, it is necessary to implement a sub-objective:

- Determine the readability of the text

Main (initial) hypothesis: The elaborated didactic text on selected thematic units in the subject of mechanical engineering will be manageable in the 1st grade in the school educational program 2381 M - mechanical engineering at a secondary industrial school and the school educational program is part of the state educational program Mechanical Engineering 23, 24 Mechanical Engineering and other metalworking production.

To verify it, we will evaluate the following working hypothesis:

H1: The selected group of students for whom the didactic text is intended from the selected text will complete 13 or more words from the 22 missing. Statistical research methods will be used to process the pedagogical experiment.

With this method, we can examine various parameters related to the subject matter obtained by measuring certain features in the textbook.

Such parameters include:

- readability of the text

4.1 Preparation and Processing of the Appropriate Content of the Didactic text

The main goals of our experiment were to select suitable literature and process a suitable didactic text for selected thematic units in the subject of mechanical technology of the 1st year in the school educational program 2381 M - mechanical engineering at the secondary industrial school. A specific school educational program is prepared for the given subject, which is part of the state educational program Engineering 23, 24 Engineering and other metalworking production. The subject of Mechanical Technology is intended to give students basic and expanding professional key competences for their possible future application in practice.

Content of the didactic text

Based on basic pedagogical documents, the subject is Mechanical Technology for the 1st year in the school educational program 2381 M - Mechanical Engineering at the secondary industrial school for tomato units. Turning is taught in the 7th thematic unit. We have divided the selected topics of the 7th thematic unit into four chapters and at the end, there are control questions:

1. Characteristics of turning
2. Lathe and its main parts

3. Lathes

4. Turning knives

Control questions

The structure of the didactic text

We processed the didactic text in the following structure:

- Objective of the selected chapter - contains basic phrases from the given module, which the student should master after studying the chapter
- Introduction to the chapter – subsection 1: Characteristics of turning
- Subchapters 1, 2, 3, 4 – are a teaching text for the given issue and describe the given issue and give an explanation of the topic covered
- Review questions - here are questions from the curriculum on turning. Answering the questions correctly is a prerequisite for successfully mastering the given topic.

Preparation and evaluation of the Cloze test for pupils

After finishing the work on the professional text, we prepared a Cloze test for the students for whom this text is intended. Select school pupils (Tab. 1) had to complete min. 13 and max. 22 missing words. If the students do not meet the lower limit and do not complete at least 13 correct words, then the learning text is complex. The cloze test is based on randomly selecting a text of approximately 250 words. We consider that the first 35 words remain in their original state for the text, but the 36th word is omitted. Subsequently, every tenth word is omitted, i.e. 46, 56, 66, 76, 86, 216, 236, 246.

Table 1: Number and schools for the Cloze test (own)

Name of the school	Number of pupils	Focus of the school
SPŠse Levice	45	mechanical and electrical engineering
SOŠE Trnava	30	electrotechnical
SOŠD Bratislava	27	traffic
SOŠSE Velešín	55	mechanical and electrical engineering
SPŠSaS Tábor	62	engineering
Σ	219	

219 respondents completed the Cloze test. The respondents (students) were from the Slovak Republic SPŠse Levice, SOŠE Trnava and SOŠD Bratislava and from the Czech Republic SOŠSE Velešín, SPŠSaS Tábor (tab. 2).

Table 2: Percentage share of the school on the Close test (own)

Name of the school	Number of pupils	% share
SPŠse Levice	45	0,207
SOŠE Trnava	30	0,132
SOŠD Bratislava	27	0,122
SOŠSE Velešín	55	0,253
SPŠSaS Tábor	62	0,286
Σ	219	100 %

5 Conclusion

Teaching aids are a very necessary means for ensuring clarity in teaching. In many cases, they connect several subjects and thus bonds in intersubject relationships are created. At the same time, there are important relations between theory and practice. Realistically, e.g. machines, devices, tools and gauges become didactic means and teaching aids in teaching and professional training. In dual education, students have real professional training in a company or factory from the second year, where they are gradually involved in production or companies have their professional training in separate workshops. Here, from the point of view of didactics, there is a connection between theory and practice, but here there is a second big dimension and that is solving the question of where to go after finishing school, if the graduate is looking for his first job.

The experimental part was solved using the statistical method, where we examined the readability of the professional text for pupils. After performing the analysis, we found that the hypothesis was confirmed. All secondary school students completed min. 13 words in Close text from the omitted 22.

Our labour market needs a lot of high-quality experts in technical fields, and the biggest problem is with craftsmen, who are massively disappearing from the market. SOŠ and OU began to adapt again to the labour market and the needs of society. Our common goal is to raise good experts and technicians, and for this we also need good teachers not only of theory but also of practice, and above all to get good experts and experienced technicians into education for the department so that students receive knowledge, experience and skills in practice (Pavlov, 2018).

Acknowledgements

The following project supported this contribution: grant KEGA No. 001TTU-4/2023 “*The development of language competences supporting the language education of future primary school teachers in schools with Hungarian as the language of instruction*”.

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The Role of STEM Education in Developing Knowledge and Skills of Primary School Students

Viera Tomková¹

DOI: <https://doi.org/10.53349/resource.2024.is1.a1263>

Abstract

The article focuses on the issue of STEM education as an effective teaching method for utilising interdisciplinary relationships. In current education, significant attention is paid to this issue, as STEM education develops students' creativity, technical thinking, and the ability to assess and articulate conclusions. The knowledge and skills acquired by students in solving tasks arising from the application of STEM education are further reinforced by using experiments focused on exploring the properties of materials that students work with. The article presents options for integrating experiments into STEM education in school practice.

Keywords: Experiment, Primary school, STEM education

1 Introduction

The Slovak Republic emphasises implementing innovative teaching methods in educating elementary and high school students. The rapid development and advancement in science and technology influence the necessity of using innovative methods in education, leading to higher demands in student education. Among the benefits associated with the use of innovative education methods is the fact that they motivate students to learn. Students become engaged in problem-solving, working in groups, communicating, presenting their opinions, and applying creativity.

The STEM education program can be classified among the innovative methods of education primarily applied in teaching natural science and technical subjects at primary and secondary schools. The STEM acronym represents four scientific disciplines: S - science, T - technology, E - engineering, and M - mathematics. STEM is an educational approach that prepares primary and secondary students for college, graduate study, and careers in science (Lutkevich, 2022).

¹ Constatnine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 01 Nitra, Slovakia.
E-mail: vtomkova@ukf.sk

2 STEM Program - Interdisciplinary Approach in Teaching Natural Sciences

In the Slovak Republic, there has been a long-standing lack of interest among students in pursuing studies at technically oriented high schools or universities (Pavelka, 2019). This trend is observable worldwide (Niculae & Niculae et al., 2011). The choice of future careers is closely linked to students' attitudes and interests in individual subjects taught.

Natural science subjects are considered uninteresting and distant from everyday life by students (Sjøberg, 2001; Herich, 2015; Fankovičová & Kubiátko, 2015; Niculae & Niculae et al., 2011; Bellová, 2021). Students cite these subjects' difficulty and perceived insignificance in their lives and future professions as reasons for their lack of interest (Sjøberg, 2001). The lack of interest in science among young people is also influenced by how science is taught in schools (Niculae & Niculae et al., 2011). Teachers play a crucial role in this regard. Fankovičová and Kubiátko (2015) found that students' interest in natural science decreases as they age. Similar conclusions were drawn in the research conducted by Veselský (1999; 2009). The most significant decline in interest in natural science subjects was observed during students' transition from primary to secondary school.

The problem of teaching natural science subjects in schools aligns with the fundamental issue of science itself: the comprehension of the world and nature.

2.1 STEM Education - Preparation of Future Technology Teachers

Besides the low interest of students in natural science disciplines, research has shown a decrease in students' knowledge levels in natural science subjects at the end of primary and secondary school (Niculae & Niculae et al., 2011). Effective interventions supporting improving students' attitudes toward natural science subjects require changes in the curriculum content and teaching strategies. The lack of interest among students in science and technology-oriented careers is one reason for implementing the STEM program in the education of natural science disciplines (Bellová, 2021). Substantial attention has been given to the issue of STEM education in the professional literature (Margot & Kettler, 2019; Bellová, 2021; Pollard et al., 2018; Stohlmann, Moore et al., 2012). STEM education encompasses the content, skills, and ways of thinking of each discipline and an understanding of the relationships between disciplines and how they support and complement each other (Pollard et al., 2018). Bellová (2021, p. 12) states, 'in many developed countries, interdisciplinary education in natural science subjects is preferred.'

As mentioned, teachers play a significant role in motivating students. Therefore, it is necessary to orient the content of education at universities, preparing future teachers of natural science disciplines for STEM education. After completing their studies, future teachers should have adopted appropriate teaching practices for effectively using the STEM program.

They should be capable of preparing suitable teaching materials to aid in learning natural science subjects, utilising the STEM program.

Employees of the Department of Technology and Information Technologies at the Faculty of Education in Nitra, as part of the international STEMkey project, innovated the educational content for students - future teachers of technical subjects in primary schools. Through innovative educational content, students learn to utilise interdisciplinary relationships between natural science subjects in solving assigned tasks.

During their studies, they work with sample materials for STEM education. One of the projects focusing on interdisciplinary relationships between natural science subjects was the design of a water reservoir and water purifier for a mountain chalet. The task worksheets represented all four areas of the STEM program (science, technology, engineering, and mathematics). The field of science explored solutions for ensuring water supply to the mountain chalet, ensuring it was helpful and drinkable. Technology was essential in designing materials for the implementation of the technical solution. Engineering represented the area of constructing the water purifier itself. Mathematical knowledge was applied in calculating the costs required for project implementation. The output of the STEM education project was the implementation of the proposed water purifier and verifying its functionality (Fig. 1).



Figure 1: Implementation of the design for a rainwater collection container and a water purifier made from recycled materials (Source: author)

During the project implementation, interdisciplinary relationships were applied between natural science subjects such as Biology, Physics, Chemistry, Ecology, Computer science

(programming the designed device using the microbit Smart Home Kit), Technology, and Mathematics.

2.2 Experimentation as a Part of the STEM Program

STEM education in primary schools enables students to be active in solving assigned tasks or projects. By utilising knowledge and skills from multiple natural science subjects, students gain a sense of satisfaction and self-realisation. Their relationship with these subjects deepens (Niculae & Niculae et al., 2011). They perceive the connection between theoretical information and its practical application. They discover new problem-solving methods and explore differences in tackling tasks, considering alternate approaches, materials, and more. They learn to experiment. Experimentation is a method that enhances students' acquisition of knowledge and skills while simultaneously developing their logical thinking (Porubská & Plavčáková, 2016). The goal of an experiment is to practically test new ideas, collect data, and evaluate it to make decisions based on information. Inquiry-based learning often employs experiments (Wörner & Kuhn et al., 2022). Through conducting experiments, students must actively engage in problem-solving and take responsibility for their learning process to discover relationships between variables and build new knowledge (de Jong & van Joolingen, 1998).

Several types of experiments are used in school practice (Mautushi, 2023): laboratory experiments, exploratory scientific experiments, practical scientific experiments, and field scientific experiments (Fig. 1).

Laboratory experiments are most used in Technology at the elementary school level. However, it is beneficial also to incorporate exploratory and practical scientific experiments. Mautushi (2023) states that teaching science through practical experiments is effective. Practical projects help students grasp scientific concepts and processes, allowing them to envision how these concepts function in the real world. By carrying out practical experiments, students understand that their knowledge can be applied beyond school activities (tests and homework).

The implementation of experiments in education is supported by the fact that they enhance students' vocabulary, enable teachers to access students' knowledge, provide students with opportunities for design and implementation, teach students responsibility, offer practical experiences, connect learning with action, develop their critical thinking, and a sense of accomplishment (Mautushi, 2023).

Figure 1 describes various experiments suitable for student education in Lab experiments, Exploratory Lab experiments, Practical Science Experiments and Fieldwork Science Experiments.

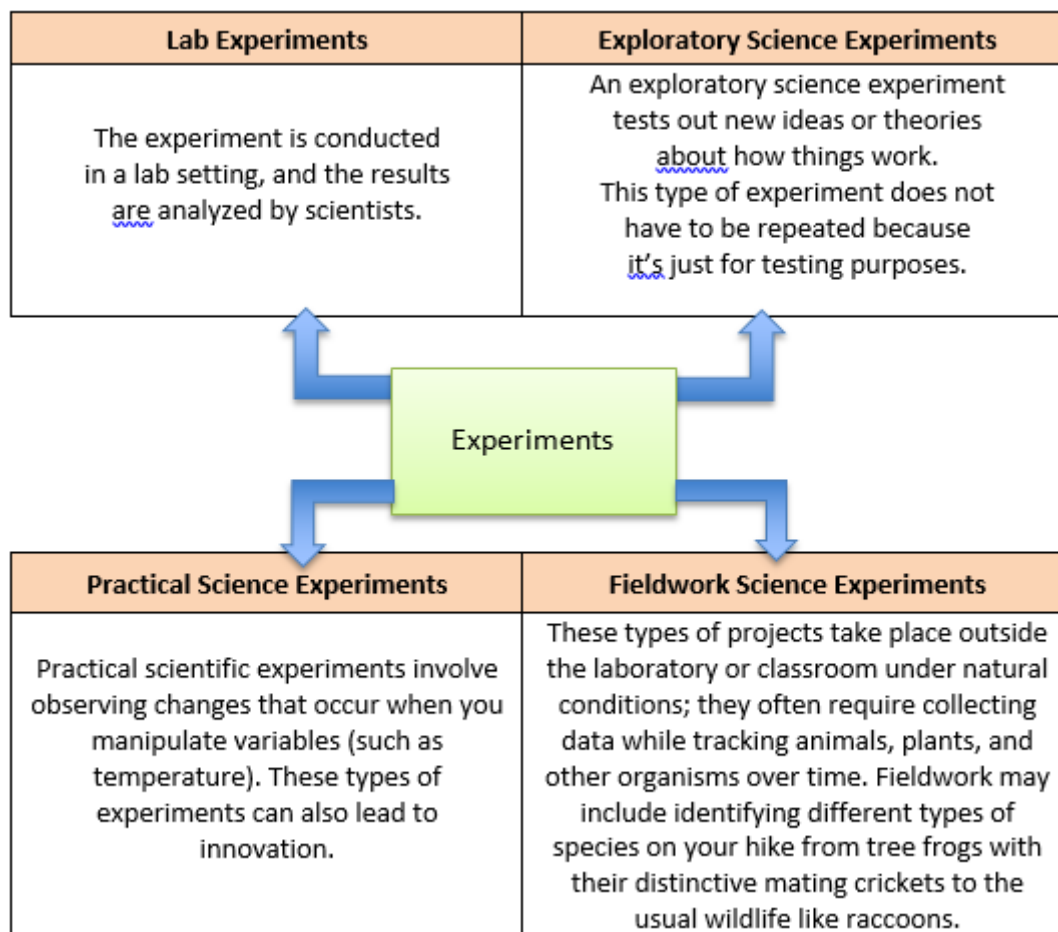


Figure 1: Types of experiments suitable for student education (Source: author)

3 Example of using experiments in carrying out tasks within the STEM program in the subject of Technology at Primary School

Technology is a mandatory part of the curriculum in the Slovak Republic. It was established as a platform for understanding technology and human creative activity in a broad context. Consequently, Technology can serve as a catalyst for developing inter curricular connections, primarily (though not exclusively) between technical and natural science subjects, as traditionally understood in their mutual connections. Table 1 provides an overview of the cross-curricular relations between natural science subjects and the subject of Technology based on an analysis of the SEP for ISCED 2.

Table 1: Cross-curricular relations with the subject technology in the ISCED 2

Subject	Topical units in the given subject	Topical unit in the subject technology	Topical unit in the subject technology
Biology	Life conditions and relations of organisms	People and technology	positive and negative impacts of technology
Physics	Work. Energy	Technology – household – safety	household heating
	Magnetic and physical phenomena	Electric power	simple electrical circuits, schematic wiring diagrams
Chemistry	Organic matters, Chemistry around us, Important chemical elements, and their compounds	Material matters and technologies.	knowledge of basic kinds of technical materials and their characteristics
Informatics	Principles of ICT operation	Graphical communication	use of the software for design activities
Mathematics	Geometry and measurement	Graphical communication	preparation of technical sketches

From the analysis results (Table 1), the subject technology offers many possibilities to create meaningful and purposeful inter-curricular relations with the natural science subjects.

Within the framework of the "Teaching standard STEM topics with a key competence approach (STEMkey)" project and the KEGA project No. 006UMB-4/2022, we have designed activities for STEM education incorporating experiments in the subject of Technology at the primary school level. Our article focuses on a specific task for students in the 8th and 9th grades of primary school (ages 14 to 15). This task is a practical experience for future technology teachers, demonstrating how to implement STEM education in elementary schools. It involves designing a system to provide water supply to a mountain cabin in an area without a natural water source. Solving this task requires students to follow a sequence of steps. Students can access worksheets focusing on different STEM areas for each solution step. In total, six worksheets are developed:

- Worksheet Topic introduction,
- Worksheet Problem to be solved,
- Worksheet Water distribution system,
- Worksheet Model of the water distribution system,
- Worksheet Model of the sand filter,
- Worksheet Financial literacy.

The worksheets follow a consistent structure. Each begins with a designated activity to be solved, for example: "How to provide water for an inherited house?" The worksheet describes the problem and requirements the student must consider while addressing. Students are allotted a specific time to solve the task (20 minutes for the given activity). As students propose solutions, there is room for experimentation. Laboratory, exploratory, and practical scientific experiments have proven to be the most suitable. Within the task's solution, students must propose methods to capture rainwater, transport it to the cabin, ensure its distribution, select the most appropriate material for project implementation, decide on water filtration methods, and ensure the water's drinkability. Figure 3 illustrates an example of a proposed water pumping system from the collection container to the filtration device.

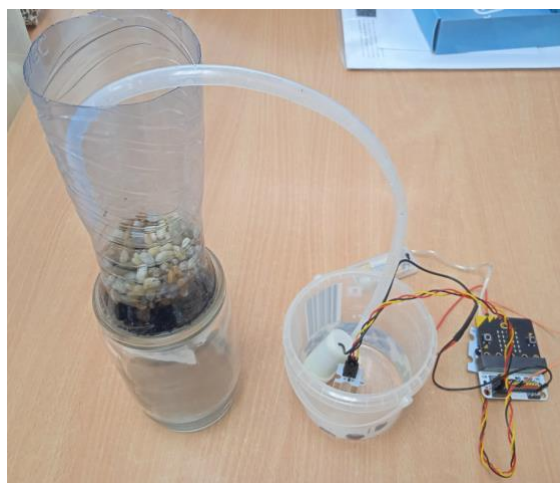


Figure 3: Example of a water pumping system design using the micro: bit Smart Home Kit.

Each partial task requires students to effectively use knowledge from all natural science subjects and practical skills. Students undergo the development of critical thinking and communication skills and utilize analysis, synthesis, and deduction in solving experiments. They learn self-assessment and conclude. Teachers can observe students' thought processes, gaining access to their knowledge and ability to apply it in new situations.

4 Conclusion

In primary schools in the Slovak Republic, the attention given to STEM education is not as significant as in developed countries that prioritise interdisciplinary education in natural science disciplines (Bellová, 2021). Natural science subjects are taught in isolation, causing students to struggle to apply the acquired information in everyday life. In our article, we presented possibilities for utilising STEM education in Technology. Students become active and motivated in their learning by solving specific practical tasks. One of the reasons for the underutilisation of STEM education in primary schools is the lack of competence among natural science teachers to employ interdisciplinary relationships among these subjects

effectively. Published research has shown that 32% of teachers lack sufficient knowledge in the second teaching subject. Furthermore, 51% of teachers identified it as a significant deficiency that similar topics are not covered simultaneously in natural science subjects (Bellová, 2021, p. 15). Improving the current situation can be achieved by integrating STEM education topics into the study plans of future teachers of natural science subjects at the primary school level, specifically aiming to develop their competence in this area.

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Learning to Cope with Problem Situations in Vocational Education/Training

Jan Válek¹, Kateřina Šmejkalová²

DOI: <https://doi.org/10.53349/resource.2024.is1.a1264>

Abstract

Resolving teacher-student conflicts in high school is a challenge that can negatively impact the learning environment, school climate, or student development. This article analyses the most common situations that cause conflicts. Based on the findings, we present a practical example (a model situation solved using the participatory method) where we tried to resolve these conflicts and improve the relationships between teachers and students. One of the School Problems, or problematic situations, is the miscommunication and misunderstanding between the mentioned parties. Conflicts often arise from misinterpreting assignments, mismatched expectations, or emotional reactions. In response to this issue, we conducted a practical experiment in the safe environment of a university, during which we simulated real conflict scenarios and looked for effective ways to resolve them. In the roles of teacher and pupils/students, some students were future teachers of practical teaching. The results show that effective communication, empathy, and dialogue can significantly reduce conflict and strengthen teacher-student interactions.

Keywords: Participative methods, Pedagogical competence, Simulation of social reality in teaching, Frequent social situations in the teaching process

1 Introduction

Milmeister, Rastoder, and Houssemand (2022) researched vocational education and its perception in different European countries. Respondents from Eastern European countries recommended vocational education, while respondents from Western European or Scandinavian countries most often recommended general secondary education. One possible explanation is the traditional value of practical and vocational education. At the same time, some of these countries' economies are strongly oriented towards producing goods

¹ Masaryk University, Faculty of Education, Dept. of Physics, Chemistry and Vocational Education, Poříčí 7, CZ 60300 Brno, Czech Republic.

E-mail: valek@ped.muni.cz

² Masaryk University, Faculty of Education, Dept. of Physics, Chemistry and Vocational Education, Poříčí 7, CZ 60300 Brno, Czech Republic.

E-mail: smejkalova@ped.muni.cz

(predominantly Eastern European countries) rather than services (predominantly Western European countries), which supports opportunities in crafts and industry. In the context of the above research, a vocational school graduate is more accessible to the Czech Republic than a general education graduate. Thus, from the perspective of secondary vocational school education, teachers need to be equipped with competencies that develop their teaching skills, as vocational skills are assumed to have already been acquired. From other investigations (Kucharčíková & Tokarčíková, 2016), (Puri, 2022), (Olimov & Mamurova, 2022) and (Leupin, 2016), reflective methods seem to be one of the possible forms of teaching such teacher competences.

One form of reflective approach to teaching is the Participative Approach. This is sometimes referred to as the interactive or student-centred method of teaching. This method emphasises student subjectivity and the student's construction of knowledge. Participatory methods assume a high level of activity and personal involvement of students in the learning process. It is recommended for smaller groups of students. They can promote better acquisition and subsequent retention of what has been learned. The method is based on simulating real situations and practising various tasks through role-playing (Průcha & Veteška, 2012). Role-playing is helpful if, students share a similar experience, which is challenging to recall due to its emotional nature. Here, learning occurs from replaying past experiences. The role-playing method is useful because it helps students to use their experiences from real-life situations; we talk about Simulation methods (Kucharčíková & Tokarčíková, 2016).

2 Simulation Methods

Lucas, Spencer, and Claxton (2012, p. 63) list five different types of practice in the context of other publications: Getting the feel, Automating, picking out the hard parts, Improvising, and Doing it for real. The latter is consistent with our concept of teaching. Of course, we recognise that this is a gradual increase in acquiring new knowledge and skills and that the last step is the most comprehensive and difficult. However, in our concept we do not impart to students the professional knowledge of their profession, but the pedagogical competencies that will help them to impart the professional knowledge to their students more effectively. The teachers of vocational educational training must be able to provide clear guidance on how to practice more effectively, such as if an activity needs to be divided into parts, carried out in a time interval with a gap, deliberately slowed down, carried out without visibility, etc. As our students, future teachers, have to acquire professional competence through repetition and practice, they now acquire teaching competence by practising behaviour in specific situations. School problems/problematic situations. (Lucas, Spencer & Claxton 2012). Learning takes place in context by developing professional competencies, focusing on pedagogical competencies applied to professional competencies. The context is essential in vocational education. Most learning takes place twice - at work and in educational institutions. A student

can be taught a skill in one place to apply it widely in another, often in the transition from school to real life. (Lucas, Spencer & Claxton 2012, p. 90)

Didactic staging prepares jobs where social interaction is an essential prerequisite for jobs. Staggering school conflicts or parts of the teaching process (called micro-teaching) can be useful for preparing future teachers. The simulation method "dramatises" the subject where possible and appropriate. Students participate in roles that are appropriate to the nature of the course. Through simulation methods, we emphasise the interrelationship of content and create a sense of the systematic interrelationship of all subjects in the curriculum. Simulation is a very effective way of establishing professional and social skills for future teachers to use in their professional and personal lives. Based on the needs of learners and the evolution of the authentic teaching practice, the project's authors plan to innovate the scenarios created. The concerned educational tool is very sensitive to the achievement of some prerequisites, and failure can eliminate the achievement of the intended educational objective. In this respect, it was mentioned that adequate time was needed to treat teaching and that material support, including the special skills and attitudes needed by teachers, was provided. (Qobilovna, 2023).

In our concept, we often talk about teaching innovation, which is the improvement of the effectiveness of the education process. Implementation of the method requires a thorough methodological and organisational preparation. In the above-mentioned problems, scenarios will be developed according to the educational objectives of the subject and the field of study where the simulation was carried out. This scenario includes, in particular, the expected knowledge and input skills of learners, the output educational competences of students, teaching time, staff and materials support, literature references and the use of didactics, the location of implementation, organisational instructions for teaching learners, input information for "active teachers" (the following: teachers), tasks for the figures (students), recommendations for solutions from the perspective of pedagogy, didactics, social psychology, communication or tactics. (Kucharčíková & Tokarčíková, 2016), (Puri, 2022), (Olimov & Mamurova, 2022)

The scenario includes a description (of the school problem) and role elaboration. It is important to capture the skills that are then actually manifested in the actions of the persons involved (teacher, students, parents) and co-create the atmosphere of the situation. The roles are not developed into full dialogues. However, their development is limited to a description of the main stages of the situation, always from the point of view of each person acting. The themes correspond to the reality and problems occurring in the school environment. The role descriptions of the other participants are unknown. (Leupin, 2016)

The teacher familiarises the learners with the situation and motivates them appropriately. Subsequently, he/she selects volunteers for the roles of actors. The teacher assigns written instructions to the actors, including a description of the person being represented and a detailed role description. The other learners will set the scene, prepare the props and then take the place of the audience. The spectators follow the action and make notes, evaluating in particular - the performance of the actors (verbal and non-verbal communication; methods

used ...), the course of the model situation, and the outcome of the situation (achievement of the goal). If not all pupils/students are involved in the different roles, it is necessary to familiarise all present with the context before the actual start of the production. Only then can the production begin. The teacher monitors the situation and intervenes only if there is a real need. If the production loses momentum, the teacher can instruct the students individually on how to play the role or indicate the direction they should take. The activity can be supplemented with audio or video recordings but in compliance with GDPR (General Data Protection Regulation) (Puri, 2022).

Once the simulation has started, the teacher observes the action, takes notes and intervenes only in the most necessary cases (e.g. when the learner drops out of the role, when the performance is stuck, when the plot diverts in an undesirable and irrelevant direction).

At the end of the simulation (after approximately ten min.), another model situation with the same or a different scenario will follow, according to the timetable. For the new model situation, learners will switch roles so that as many people as possible are involved in the storyline.

An important step is the evaluation of the performances of each actor in the simulation. The trainer starts a feedback session in which the actors perform first. The actors should self-critically assess their performances. Then, the learners (audience) give their comments. During the performances of the two groups mentioned above, the teacher will only be the discussion moderator. During the discussion, the teacher will guide the learners to the optimal solution of the scene/situation using questions. Finally, the teacher will evaluate the whole activity and reiterate the optimal solution that meets the requirements of pedagogy, didactics, psychology, law, and communication.

3 Research in the Preparation of Future Teachers

In this paper, we present partial outputs of the project, which responds to the current needs of students of the bachelor's programme Teaching Vocational Education and Training and the follow-up master's programme Teaching Vocational Subjects for Secondary Schools. A survey of students in real teaching practice in secondary vocational schools has identified suggestions for curriculum innovation in the programme.

The existing content of the courses is taught not only in the form of a lecture but the method of conversation and discussion of the possibilities of solving specific educational and training problem cases from teaching practice is used. By incorporating simulation teaching, learners actively address the situations they are most likely to encounter in practice and, as the survey revealed, perceive them as problematic.

Forty-nine respondents (N = 49) participated in the study in April 2023. The respondents were the above-mentioned undergraduate or postgraduate students. Since approximately half of the students in the program are currently in a combined program and often already teach in secondary vocational schools, they face specific educational and training problems

they address in their teaching practice. The innovative courses are aimed at developing the competences and skills of the students, future teachers, which they will apply in their practice. Another reason for the introduction of simulation teaching is the greater effectiveness of such teaching in the acquisition of appropriate knowledge, skills and attitudes. Pathological phenomena in society (as shown by the Czech School Inspectorate reports) are also manifesting themselves to an increased extent, which teachers have to address in their classes.

The questionnaire asked about two School problems/problematic situations that the respondents encountered and in which role they were (Student, Parent, Teacher, Teaching Assistant, Student in teaching practice at university, or Another role), results in Table 1. The results show that these are overwhelmingly problem situations perceived from the teacher's perspective.

Table 1: Role of respondents in individual problem situations

Role	Problem situations #1	Problem situations #2
Pupil/Student	6	3
Parent	0	1
Teacher	25	21
Teaching Assistant	3	2
Student in teaching practice at a university	13	16
Another role	0	0

Other questions focusing on problem situations were:

- Why do you perceive this situation as problematic?
- Describe how the situation was solved.
- Rate whether the solution was correct.
- Who would you turn to if you did not know how to solve the situation yourself, and why this person?

Respondents described problem situations they encountered. In the analysis, we assigned the following characteristics to the situations: Discipline of pupils/students in the teaching unit (n = 43); communication with parents (n = 7); health of pupils/students (n = 7); management of teaching (n = 5); pupils'/students' behaviour (n = 4); pupils'/students' motivation (n = 4); aggression of a pupil/student towards a pupil/student or a teacher (n = 3); teacher's authority (n = 2); bureaucratic apparatus and out-of-school organisation systems (n = 2); pupils'/students' psychological problems (n = 1); pupils'/students' work in the teaching unit (n = 1). The sums of situations do not agree with the number of respondents ($\sum n \neq N$), as some recalled only one situation.

We were also interested in why they rated the situation as problematic. Most often, respondents were concerned about the health of those involved, were shocked by the

behaviour of the actors in the situation or were not aware of the teacher's handling of the situation.

From the answers to the questions (Describe how the situation was solved; Rate whether the solution was correct; Who would you turn to in case you did not know how to solve the situation yourself and why this person?), it was mostly a correct identification of an inappropriate solution to the situation, however, in other comments the respondents were asked how such a situation should have been solved correctly.

4 Outputs Based on Research

The project aims to incorporate a simulation method into teaching students in the field of vocational education - the so-called model situations from the standard school environment of secondary schools. A timetable of teaching a full-time form of study: 4x3 lessons are devoted to implementing the method of model situations (= 4x3x50 minutes). A timetable of teaching a combined form of study: 1x4 lessons (= 1x4x50 minutes) are devoted to the implementation of the method of model situations.

More problem educational areas/problem situations will be developed, which future teachers will encounter in their teaching practice. We present only three:

1. distraction of pupils/students in teaching (focusing on attention, motivation of students),
2. communication with parents (unpleasant behaviour),
3. dealing with bullying in the classroom - the classroom lesson.

Scenarios for the mentioned educational problem situations were developed as part of the content and methodological preparation for the implementation. The project will include creating teaching material (learning support) on the issue of simulations of various teaching situations. Tables 2, 3 and 4. (Note: Situations are numbered in the following tables according to internal markings.)

Table 2: Scenario of the problem situation 1

SITUATION 1: Discipline in the classroom
The role of the student
<p>Petr is in the 2nd year of secondary vocational school. He enjoys hockey and all kinds of exercise, even during school hours. Following the set rules of behaviour seems to be a superhuman task for him. He cannot, for example, speak only when called upon, sit still and do what the teacher says, not shout at his classmates when he is thinking of something, etc. Sometimes, he shouts at a classmate who does not want to cooperate with him. The teacher calls it swearing. According to Peter, it's not that bad. When he gets angry, his dad says he talks in a completely different way.</p> <p>Communication suggestions for the student: "Why do I have to learn this? Could I watch hockey, my parents are playing now?" He turns to his classmates and encourages them to play the game with him. First, he asks one classmate, then when he is not interested, he turns to another. If they don't want to cooperate with him, he shouts at them in a rude way. "It's not fair of you." "Teacher, let him play with me, do you think what you are telling us is good for anything?" When the teacher calls out one of his classmates, he dehumanises their answer, whether it is correct or not: "They keep reporting and still the answer is not much, I know that too." Or, "We've already said it, so let's go to lunch; I'm tired of it." "He doesn't know, so don't call him out and tell him yourself, teacher."</p>
Role Classmates
<p>His classmates are annoyed by Peter's behaviour; he draws attention to himself, shouts indiscriminately at them and comments loudly when something goes wrong. The classmates do not want to cooperate with Peter; they show it and try to get the teacher's support.</p>
The role of the teacher
<p>You are a beginning teacher teaching a specialised subject. Your colleagues, including an experienced class teacher, complain about Peter's behaviour. The class teacher and his colleagues complain that Peter's behaviour is worsening. Even consulting with parents has not helped.</p> <p>Choose some lesson preparation you have previously worked on and start teaching the class. Try challenging the pupils/students to make the lesson interesting and active.</p>

Table 3: Scenario of the problem situation 2

SITUATION 5: Discussions with parents about the student's progress
The role of the parent 1
<p>You have a child with no educational problems, but he's having trouble with his grades. The teacher must have picked on him, he's unfair. If the teacher has the idea that my child can't do something, it's his problem - he's not teaching well. You go to school, and you talk to the teacher who is complaining about your child.</p> <p>You are arrogant and in no way admit fault on your child's part, the fault lies with the teacher.</p>

The role of the parent 2
You have a child with no educational problems, but he's having trouble with his grades. The teacher must have picked on him, he's unfair. If the teacher has the idea that my child can't do something, it's his problem - he's not teaching well. You go to school, and you talk to the teacher who is complaining about your child. You are calm, but you are not willing to admit that the fault lies with your child. You contradict the teacher and, finally, promise to talk to your child.
The role of the teacher 1, 2
You are a teacher who has called a student's parents to the school because of a failing grade. In addition, the student has cheated on written work, copied, has no homework, etc. Try to reason with the parents.

Table 4: Scenario of the problem situation 3

SITUATION 8: Problem Parents - Addressing Bullying with the Parents of the Aggressor
The role of parents
Christopher started at the secondary vocational school; from the beginning he was accompanied by behavioural problems. At first impression he seems quiet, but he managed to win over his classmates who then "served" him. He often had conflicts with classmates who did not want to submit to him. He ignored his teachers and behaved in a purely purposeful manner. He was very quick to comment and put down teachers in front of the whole class. Christopher was above average intelligence. As parents, you're in frequent contact with the school. They would come in to complain about various teachers, their attitudes, and practices. Father included the school with various suggestions as to what the school should change to help Christopher thrive better. Teachers agreed that Christopher was smart and handled the curriculum with ease. However, they also have to take into account his completely inappropriate behaviour, which is lowering his grades by at least one grade level. Thanks to a lot of pressure from his parents, Christopher has so far managed to get through to Year 2 "only" with a reprimand from his class teacher. A week ago, the classroom situation escalated. There was an incident in which Kryštof grabbed a classmate's hand and cruelly broke a bone in the wrist of her left hand. Resistance arose not only from their parents, which culminated in a request for Christopher to be transferred to another class, or better yet - to another school. You are Christopher's parents; you are invited to school by the class teacher. You are fundamentally opposed to any solution the teacher proposes: reassignment, discipline, ... you show no regret. You argue: the field of education, which is in another school 50 km away, the intellect of Christopher, the girl definitely caused her own injuries, the school is to blame.
The role of the teacher
Christopher started at the secondary vocational school; from the beginning, he was accompanied by behavioural problems. At first impression, he seems quiet, but he managed to win over his classmates, who then "served" him. He often had conflicts with classmates who did not want to submit to him. He ignored his teachers and behaved in

a purely purposeful manner. He was very quick to comment and put down teachers in front of the whole class. Christopher was above average intelligence. As parents, you're in frequent contact with the school. They would come in to complain about various teachers, their attitudes and practices. The father included the school with various suggestions as to what the school should change to help Christopher thrive better. Teachers agreed that Christopher was smart and handled the curriculum with ease. However, they also have to take into account his completely inappropriate behaviour, which is lowering his grades by at least one grade level. Thanks to a lot of pressure from his parents, Kryštof has so far managed to get through to Year 2 "only" with a reprimand from his class teacher.

A week ago, the classroom situation escalated. There was an incident in which Christopher grabbed a classmate's hand and cruelly broke a bone in the wrist of her left hand. Resistance arose not only from their parents, which culminated in a request for Christopher to be transferred to another class or, better yet - to another school.

What are you going to do? You invited Christopher's parents to school, you don't feel good about it, but you have to deal with the situation.

Solution options

Assess criminal responsibility. (Youth Responsibility Act)

Consultation with the Police of the Czech Republic.

Talk individually with Christopher about how he would handle the situation now.

Talk to Christopher's parents. (Getting from a position of "the school is fighting with you" to a position of "the school wants to work with you to find a solution to this situation").

Open a discussion with the students in class on the topic of rights violations, aggression.

Recommend family therapy to parents.

Recommend expulsion from school to the principal.

Set up, support long-term cooperation with school counsellor, external psychologist.

Establish an agreement between teacher, parents, school, or other interested parties.

5 Conclusion

The model situations were piloted with third-semester students of the above-mentioned bachelor program. The learners evaluated the teaching method used positively. They found the situations engaging and followed a pre-prepared script during the staging. The feedback, as well as the analysis of the problem solved, was beneficial for the learners. During the feedback, the learners also actively discussed issues that could arise in teaching practice.

The structured staging methods have a precise scenario beforehand. Students are forced to explore the issue in depth and from multiple perspectives. This fact develops critical thinking in students. It is interesting to see and point out the student's own mistakes. The class was conducted in a friendly atmosphere and gave students an insight into the teaching profession. Positive can be seen, especially in the students' statement that they did not think that the teaching profession is so demanding in terms of preparation and communication. We have also achieved learners' activity regarding their choice of problem situations. The authors'

intention to activate the students in the teaching and also to motivate them to participate in the ideas for the scenarios, was successful.

We reiterate that the most important thing is a safe environment where the student can try out different solutions to problems.

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Professional Competence of Teachers Concerning the Content of the Educational Area: Man and the World of Work in Pre- primary and Primary Education

Monika Valentová¹, Peter Brečka², Alena Hašková³

DOI: <https://doi.org/10.53349/resource.2024.is1.a1265>

Abstract

In the introduction of the paper, the issue of the quality of technical education from the point of view of the professional competence of teachers, with a focus on undergraduate preparation of future teachers and their successful performance in their future careers, is discussed. Further, in more detail, the authors analyse study programs, including the teaching subjects incorporated into them, of pre-primary and primary education at three universities in Slovakia concerning the content and goals of the educational area Man and the world of work. Results of their comparative analysis have shown significant differences in the teacher trainee preparation at the concerned universities. As to the bachelor study programs, these correspond with the topics of the educational area. In the master study programmes, the topical units of the educational area are indicated indirectly in the frame of the learning outcomes. At the same time, the emphasis is put mainly on didactical aspects.

Keywords: Technical education, Practical preparation, Undergraduate training, Pre-primary education, Primary education

1 Introduction

Teacher quality support is crucial in improving education (Harris & Sass, 2011) and represents an essential social science phenomenon in many countries, including Slovakia. In connection

¹Department of Technology and Information Technologies, Faculty of Education, Constantine the Philosopher University in Nitra, Dražovská 4, 949 01 Nitra, Slovakia.

E-mail: mvalentova2@ukf.sk

²Department of Technology and Information Technologies, Faculty of Education, Constantine the Philosopher University in Nitra, Dražovská 4, 949 01 Nitra, Slovakia.

E-mail: pbrecka@ukf.sk

³Department of Technology and Information Technologies, Faculty of Education, Constantine the Philosopher University in Nitra, Dražovská 4, 949 01 Nitra, Slovakia.

E-mail: ahaskova@ukf.sk

with this, there are increasing demands for improving the quality of teaching at all levels of study, thus also in universities (Yusuf, 2005). Currently, there are 35 universities in Slovakia. Of the total number of universities, six technical universities provide technical education (Slovak University of Technology in Bratislava, Technical University in Košice, University of Žilina in Žilina, Trenčín University of Alexander Dubček in Trenčín, Slovak University of Agriculture in Nitra and Technical University in Zvolen). The schools mentioned above offer many specialised programmes and fields of study, which make them highly recognised institutions providing vocational training for various areas of life.

However, including technical education in preparing students to become future teachers (Subrahmanyam, 2020), emphasising the didactic regularities of technically oriented subjects, is particularly significant. The undergraduate preparation for the profession of a teacher of occupational education for kindergarten and occupational education for primary school is vital. The preparation consists of acquiring theoretical expertise in pedagogy, psychology and the sciences of technical teaching subjects. The goals and objectives of this education should reflect the emphasis that is placed on the development of competences necessary for their future profession while applying such strategies that will achieve the fulfilment of the current requirements of society in the field of technical education in schools (Bahodirovich & Romilovich, 2021). Such training is carried out at three universities in Slovakia: The University of Constantine the Philosopher in Nitra, the University of Prešov in Prešov and the Matej Bel University in Banská Bystrica.

These schools include technical education in the university training of future teachers for pre-primary and primary education in Teaching and Educational Sciences in the study programmes of Pre-school and Elementary Education (bachelor's degree) and Teaching for Primary Education (Master's degree).

Educational institutions must continuously adapt their courses and seminars to achieve the practical sustainability of their programmes in rapidly changing job demands (Oraison et al., 2019). Quality university education should prepare students for their future profession. The focus should be on developing competencies that will achieve the current social demands and educational standards in technical education.

2 State Educational Standard and the Educational Area Man and the World of Work

On 6th July 2016, with effect from 1st September 2016, the State Educational Program for Pre-primary Education in Kindergartens (from now on, referred to as SEPO) was established. The main goal of education and training that results from this document is the achievement of optimal cognitive, sensorimotor, and socio-cognitive levels as a basis for school education in primary school and for life in society (SEPO, 2016). The content of this program is structured into learning domains in a similar way to primary schools:

- Language and communication.
- Mathematics and working with information.
- Man and nature.
- Man and society.
- Man and the world of work.
- Art and culture.
- Health and movement.

The work component is implemented through the educational area Man and the world of work, which is further subdivided into these areas:

- Materials and their properties,
- Constructing,
- User skills,
- Production technologies,
- Crafts and professions.

The main goal of Man and the World of Work is to shape and develop the child's basic skills, mastering the tasks of daily living and skills in using the tools needed in everyday life. The emphasis is on developing those skills that are developmentally important for the child, for example, to better manage graphomotor predispositions, self-care activities, and everyday household tasks (SEPO, 2016). The updated State Educational Program focuses on developing elementary technical thinking, including activities for experimentation and solving simple problems in which children can explore the properties of materials by trial and error, look for different solutions, and create original new procedures and solutions.

Since 1 September 2015, an innovative State Educational Program (from now on referred to as ISEP1) for primary schools has been in force. Technical education is carried out in work-based education in the 3rd and 4th grades and the lower secondary level in technology. Both subjects have undergone significant restructuring due to the subject commission at the State Pedagogical Office for the field of Man and the world of work (Kožušková & Stebila, 2014). The content of the subject of work-based education focuses on developing key competences and skills applicable in various spheres of human life. Changes have also occurred in the standard, where students' performances are more clearly defined (thus better measurable) at different levels according to B. S. Bloom's taxonomy. In addition, the updated educational standard allows pupils to do activities such as searching, investigating, exploring, discovering, manipulating objects, experimenting, and constructing, as these are the essential prerequisites for developing their practical skills. The content focus of the subject is now more oriented towards more complex activities and technologies, as well as individual work and teamwork, which are the most desirable competences from a society-wide perspective (Brečka & Valentová, 2018).

The educational standard consists of the subject's characteristics and the basic learning objectives specified in the performance standard. The educational content of the subject of

work-based education contributes to the formation of life and career orientation of pupils. The curriculum is divided into five sub-areas (Table 1).

Table 1: Overview of the subject units of Work-based education (ISEP1, 2015).

Educational area Man and the world of work	
3rd grade	4th grade
Man, and work	Man, and work
Creative use of technical materials	Technical materials
Fundamentals of construction	Fundamentals of construction
Catering and preparation of dishes	Preparation of dishes
Folk traditions and crafts	Folk traditions and crafts

The educational field encompasses various work activities and technologies based on creative teamwork. Through technical education, pupils are guided to acquire basic user skills in various fields of human activity. Throughout the whole process of teaching technology at the primary level of education, the goal is crucial: forming a technically, intellectually and emotionally creative person who will orient himself/herself in the information society.

ISEP1 for the educational area Man and the world of work is based on the requirements of practice, focusing on primary school graduates' knowledge and practical skills to consider pupils' attitudes and career orientation. The requirements are placed more on new forms of teaching, such as investigation and experimentation. They aim to make pupils active and acquire knowledge through practical activity and trial and error. Hence, there are increasing demands on teachers, on their pedagogical and mainly practical training, on their professional competences (Naydenova & Naydenova, 2016) because the teacher is the one who plays a vital role in the successful implementation of the curriculum (Prasetyono et al., 2021).

2.1 Methods and Results of the Analysis

Practical training occurs in university education through technical subjects, resulting in a professionally qualified technology teacher. We aimed to compare the subjects in the preschool and elementary pedagogy study programs (PEP) and Teaching for primary education (UPV) at all three universities in Slovakia with the content and objectives of the educational field of Man and the world of work. The analysis aims to obtain the basis for preschool and elementary pedagogy study programs (PEP):

- assessment of the professional competence of teachers of technical subjects,
- specifying the gaps in students' professional preparation to find out what they need to improve concerning the teaching of technical subjects,
- improving the quality of undergraduate student training so that the educational programs of all universities are meaningful and connected to practice,
- making universities competitive and securing their prospects.

We used a case study because several aspects of the teaching subjects were examined (analysed) about the educational area of Man and the world of work. A case study provides an in-depth exploration and multifaceted understanding of an issue in a real-world context (Crowe et al., 2011). The analysis of the subjects occurred in two stages.

- A. Comparison of subjects in the pre-school and elementary pedagogy study program (PEP) with the educational area Man and the world of work,
- B. Comparison of the subjects in teaching for primary education programs (UPV) with the educational area Man and the world of work.

In both cases, the technical subjects in the programs, their content focus (curriculum) and learning outcomes (performance standards) were examined. Subsequently, we compared them with the educational area's objectives and content focus (sub-areas). We included only compulsory subjects of a technical nature at all three universities in the analysis (Table 2).

2.2 Comparison of Subjects in PEP Programs with the Educational Area Man and the World of Work.

An overview of the results of the analyses processed during the first stage of the comparative study (see the above-stated stage A) is summarised in Table 1.

Table 2: Comparison of subjects in PEP programs with the educational area Man and the world of work – SEPO.

Man and the world of work		UKF Nitra	UMB Banská Bystrica	PU Prešov
		Working techniques in pre-primary education	Science and technology education	Work-technical education
Themes arising from the SEPO	Objectives of the educational area	✓	✓	✓
	Developing skills in working with tools	x	x	x
	Household activities	x	x	x
	Development of elementary technical thinking	x	x	✓
	Development of creativity	x	x	x
	Investigating the properties of materials and objects (trial, error, experiment)	✓	✓	x
Sub-areas	Materials and their properties	✓	✓	✓
	Constructing	x	✓	✓
	User skills	✓	x	✓
	Production technologies	✓	✓	x
	Crafts and professions	x	x	✓

From a comparison of the content of the courses in the PEP and SEPO study programs, we can express the following findings:

- It is interesting to note that no university has a complete alignment of its programs with the standards of the educational field.
- There are no differences across schools regarding meeting course objectives, which undoubtedly indicates that all universities have the same intent in preparing students to meet educational objectives.
- Themes focusing on applying methods of investigation, research and experimentation are evident in the study programs of UKF and BB.
- PU forms an exception in developing elementary technical thinking in line with SEPO.
- Other target requirements in the contents of compulsory courses at individual universities were not indicated compared to the SEPO targets.
- Within the sub-areas resulting from SEPO, the topic „Materials and their properties“ is consistently included in the compulsory subjects at all universities. According to the information lists, the construction area is absent in the teaching at UKF in Nitra, User Skills at UMB in BB and Production Technology at PU. The area of crafts is absent at UKF in Nitra as well as at UMB in Banska Bystrica.
- The analysis also recorded topics beyond the requirements of SEPO: in Nitra, it is the issue of safety and hygiene at work with technical materials; in BB, the topic of strategies and methods of science/technical education; and in PU, the topic of work-technical interest activities in school educational institutions.

The comparison shows that students acquire basic knowledge about the content of the educational area, the individual sub-areas, and the content and performance standards necessary for teaching. However, less attention is paid to developing strategies for supporting creativity, skills, and technical thinking resulting from the educational area of Man and the world of work.

However, we can assume that the missing components of SEPO are included in the compulsory elective courses of the individual universities.

UKF – Working skills with materials, Methodology of work-based education; BB – Working with technical materials; PU – Natural, geographical, and technical interest activities; Transport education.

2.3 Comparison of Subjects in the Study Program Teaching for Primary Education

An overview of the results of the analyses concerning the area of Man and the world of work for primary education processed during the second stage of the comparative study (see the above-stated stage B) is summarised in Table 2.

Table 3: Comparison of subjects in the study program Teaching for primary education (UPV) and the educational area Man and the world of work for primary education (ISEP1).

Content standard	Compulsory subjects		
	UKF Nitra Work-based education with didactics	UMB Banská Bystrica Didactics of science and technology education	PU Prešov Didactics of work-based education
Thematic units, according to ISEP1	x	x	x
Basic curriculum documents	✓	✓	✓
Objectives of technical education	✓	x	✓
The teacher and his/her competences	✓	x	✓
Planning and preparing for lessons	✓	✓	✓
Assessment and classification	✓	✓	✓
Material security of the teaching process	x	x	✓
Safety and hygiene attributes of work activities	✓	x	x

From the comparison of the contents of the didactics and ISEP1 (Table 3), we can observe that the thematic units resulting from the educational area Man and the world of work are not directly indicated in the information lists of the individual universities. We can deduce a certain degree of their fulfilment from the defined conditions for the completion of the subjects and the learning outcomes to be achieved by the students at the individual schools (creation of didactic materials and aids for the technical area, demonstration of knowledge of the curriculum, orientation in the educational area, creation of preparations for the topics from the textbook of work-based education and SEP, and others).

Within the master's degree of university training of students, technical education is implemented in subjects with an emphasis on didactics, which is in line with the profile of the graduate. Hence, the structure of topics in the courses and information lists. Didactic topics are included almost identically in the contents at all three universities. The exceptions are the topics of material support for teaching and safety issues in work-based education.

3 Summary of Results and Analysis

Based on comparing the curricula of different universities, it may seem that some subjects are too specific, others relatively less so. Schools have developed their own specificities in delivering technical education, but about two-thirds of the topics in the bachelor's degree are common. In the master's programs, the subject areas are mentioned indirectly in the learning outcomes, with a particular emphasis on didactic aspects. Based on the results, we can only conclude that, at present, the contents of the compulsory subjects at all universities are satisfactory and well-set and exemplify good undergraduate preparation of students for

teaching technical subjects at the pre-primary level. To a greater extent, they are in line with the standards of the educational area Man and the world of work for pre-primary education, and therefore, the students have the prerequisite to acquire the professional competence to exercise the teaching profession in the given field. They will acquire knowledge about materials, their processing technologies, and the choice of these materials for a given level of education. Last but not least, they will be able to apply the acquired knowledge to the design and creation of situational tasks of pupils' learning for the educational area Man and the world of work with complex didactic analysis and self-reflection.

Despite some differences in the PEP and UPV programs at the different universities, we can argue that they meet the contents of the educational area and the national curriculum. The courses have a good structure. However, the problem we perceive is that the areas lacking in the compulsory courses are further elaborated in the optional courses, but every student may not choose these. This situation implies that not all graduates have the necessary competences for quality teaching of technical subjects and, therefore, complete competence for the given educational field. We know from experience and practice that students who do not also take compulsory elective subjects have difficulties in orientation in all materials. They have no room for developing their fine motor skills and imagination, which are reflected in their final practical outputs or theses.

4 Conclusion

The paper partly suggests research possibilities in the practical preparation of teachers of technical subjects. It points out some differences in the framework of students' preparation and the contents of the educational area Man and the world of work. However, we perceive the lack of integration of innovative educational strategies such as STEM and STEAM in all curricula as a problem. The European Union (2016) „encourages Member States to better prepare young people for changing labour markets, to develop their competences in science, technology, engineering and mathematics and skills of the 21st century“(Dede, 2007). STEM skills and highly qualified teachers in the field are seen as crucial elements by which it is possible to achieve these goals. Some bachelor's study program topics can be included in the field (Materials and their properties, investigating the properties of materials – trial and error, experiment and construction). However, they are too general; therefore, it is unclear whether universities address the issue of integrating STEM. For this reason, it is crucial to make this education part of students' undergraduate training and to enable them to acquire knowledge of this teaching methodology and develop the relevant competences. To obtain comprehensive results and the aim of further investigation, we will conduct further analysis to verify what teachers lack or have lacked in their undergraduate preparation. Subsequently, we will specify and develop a way to re-educate them.

Acknowledgements

This paper was written in the context of the KEGA project No. 018UKF-4/2023, Further Education of Teachers in the educational area Man and the World of Work and the VEGA project No. 1/0213/23 Developing the Learning Potential of pre-school and Younger School-age children in the focus on the concept of STEM education.

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Educational Needs of Form Teachers in Primary and Secondary Schools in Slovakia: Pilot survey results

Ján Záhorec¹, Alena Hašková², Ján Gunčaga³

DOI: <https://doi.org/10.53349/resource.2024.is1.a1266>

Abstract

An innovative approach to delivering pre-service teacher training to student teachers in individual areas is considered crucial in the smooth digital transformation of education in Slovakia. One of the major shortcomings of the current pre-service training of student teachers is the fact that not all higher education institutions involved in the teacher trainee preparation have incorporated into the relevant part of the curricula the area of acquisition of specific competences of the form teachers with such accent as the requirements of practice would require. The authors present the conceptual and methodological background of a pilot sample survey focused on self-assessment of the educational needs of form teachers at the secondary level of education in Slovakia. The specification of the assessment areas was based on extensive research of available literature, as well as on personal discussions led by different experts.

Keywords: Pre-service teacher training, Self-assessment of teachers, Form teacher, Pedagogical innovation, Research instrument verification

1 Introduction

Quality professional preparation of teachers is one of the key themes of the expert discussions, devoted to the content changes in undergraduate teacher training programs at

¹ Faculty of Education, Comenius University Bratislava, Račianska 59, 813 34 Bratislava, Slovakia.

E-mail: zahorec@fedu.uniba.sk, corresponding author

² Faculty of Education, Constantine the Philosopher University Nitra, Dražovská 4, 049 01 Nitra, Slovakia.

E-mail: ahaskova@ukf.sk

³ Faculty of Education, Comenius University Bratislava, Račianska 59, 813 34 Bratislava.

E-mail: guncaga@fedu.uniba.sk

universities. One of the major shortcomings of the current pre-graduate training of student teachers, in agreement with Hermochová (2010), is the fact that not all higher education institutions involved in the preparation of future teachers of regional education (primary and lower and upper secondary level of education) have incorporated into the relevant part of the curricula the area of acquiring specific competences of a form teacher at such a level, as the requirements of practice would require (Kondrla et al., 2023). In the context of the above, a grant project is being carried out at the Faculty of Education of Comenius University, the aim of which is to innovate the curricula of the relevant part of the study programs of the undergraduate preparation of future teachers so that the graduates of teacher study programs would be better prepared for specific situations related to the key competences of a form teacher in primary and secondary schools. By specific situations, we mean situations de-terminated mainly by form teachers' communication with pupils' (students') guardians in solving learning and behavioural problems, classroom organisation and management, and interpersonal relations among pupils (students).

At this point, we consider it necessary to note that the paper is a follow-up to a paper presented at the 26th *International Conference on Interactive Collaborative Learning* (Záhorec et al., 2023). In the conference paper, the authors outlined the research design and data collection that followed. The paper also summarises the results of pilot testing of the developed measurement tool to assess its reliability and to identify suspect items through reliability/item analysis. The current paper discusses the results obtained from the pilot survey aimed at self-assessment of the educational needs of former teachers at the secondary level of education (ISCED 2; ISCED 3) in Slovakia in a broader context.

2 Context of the Research and Objectives

Pedagogical research has always focused on the teacher, but the form teacher has not enjoyed much popularity in the Czech research environment, especially in recent years (Bendová, 2016), and the same is true for Slovakia as well. More recent research focusing on the position of the form teacher includes the research of Krátka, Gulová, Střelc (2020) and Bacúšan Nevolná (2023). However, research on teachers in general also yields valuable findings more closely tied to the specialized activity of the form teacher.

Analysis of international theoretical and research studies has identified areas where novice teachers encounter problems, one of which is that their preservice training does not equip them with sufficient knowledge, skills, and dispositions to practice the profession (Vítečková et al., 2016; Gadušová, Vítečková, 2014; Freeman et al., 2014; O'Neill, Stephenson, 2011; Cíbičková, 2012; Jones, 2006; Pigge, Marso, 1997). Průcha (2009) states that based on the results of research conducted in the countries of the USA, Canada and Australia, beginning teachers encounter problems in practice, such as, in particular, maintaining discipline in the classroom, motivating pupils, developing relationships with parents, organizing the work of pupils in the classroom, etc. This is closely related to the fact that from day one they perform

various duties, including those of a form teacher, which is also confirmed by the research of Kalhous and Horák (1996), and Bacúšan Nevoľná (2023). However, teachers rate the university preparation for the position of a form teacher as insufficient (Boďo, 2011).

University preparation related to classroom management has long been perceived by teachers not only in our environment but also abroad as a weaker aspect of their preservice training, with teachers pointing primarily to its overly theoretical (Cothran, Kulinna, Garrahy, 2003; Šimoník, 1994; Havlík, 2003; Vašutová, 2004; Valkovičová, 2008; Pavera, Cudlínová, 2019). Preparation in the field is usually evaluated positively by teachers, but preparedness in dealing with pupil discipline, working with pupils with special educational needs (SEN), cooperation with parents, or mastery of pedagogical documentation is evaluated as insufficient (Vítečková, Gadušová, 2015).

Which areas of classroom management do teachers reflect as deficient in their teaching activities? Based on the analysis of research findings, it appears that communication with parents and problem behaviour of pupils, which are among the significant sources of teachers' professional load, are not sufficiently covered in preservice training (Lasky, 2000; Keyes, 2002; Pavlas et al., 2019; Viktorová, 2020; Urbanovská, 2017; Fazel et al., 2014). Coping with pupil problem behaviour is a challenging area of classroom management, but not only novice teachers in Slovakia but also abroad (Nagyová, 2016; Hong, 2012; Johansen et al., 2011) specifically perceive their lack of preparedness to prevent and deal with pupil problem behaviour. Similar is the case with preparation for working with pupils with special educational needs (Oliver, Reschly, 2010; Hunter-Johnson et al., 2014) and keeping pedagogical documentation (Bacúšan Nevoľná, 2023; Havlík, 2003; Vítečková, Gadušová, 2015).

3 Development of a Methodology for Self-assessment

The purpose of the conducted sample survey was to map the opinions of a selected sample of teachers at the (Slovak) secondary level of education (ISCED 2; ISCED 3) on the need for further education in selected activities of a form teacher to form and develop their professional competences. The research sample consisted exclusively of teachers performing the activity of a form teacher at the secondary level of education according to the legislative provision of § 37 (section 2) of Law No. 138/2019 on pedagogical employees and professional staff. The sampling frame for implementing the questionnaire survey was constructed using the available sampling technique.

We used a quantitative approach to address the research problem. The methodology of the analysis of self-assessment of educational needs of teaching staff in the career position of a form teacher in primary and secondary school (ISCED 2; ISCED 3) was based on screening the opinions of teachers with different lengths of teaching experience, with a different focus of their subjects (majors), as well as concerning different levels and levels of school education, at which the teachers in question operate according to the Law No. 245/2008 on education and training.

To screen the opinions of the research sample of participants, we used a questionnaire consisting of 89 items incorporated into seven areas of the inquiry:

- area *A* – aimed at identifying the respondent in terms of his/her gender, length of teaching experience in the (career) position of a form teacher, as well as with regard to the nature of the subjects s/he teaches or the type of school in which s/he concerned work, etc.;
- area *B* – aimed at identifying needs for further training of the form teachers in selected administrative activities related to the job of a form teacher in a primary/secondary school;
- area *C* – aimed at identifying needs for further training of the form teachers in the area of coordinating the classroom in which they serve as a form teacher;
- area *D* – aimed at identifying needs for further training in selected educational activities falling within the competencies of a form teacher in a primary/secondary school;
- area *E* – aimed at identifying needs for further training of form teachers in selected activities falling within the field of communication and cooperation of the form teacher with the school management, with pedagogical and professional staff of the school, with the pupil's legal representatives, with representatives of various institutions and organizations, with pupils;
- area *F* – aimed at identifying needs of form teachers for further education in the field of pedagogical diagnostics falling within the scope of a form teacher's work;
- area *G* – aimed at identifying needs of form teachers to undertake further training in the area of selected preventive activities related to their job description as a form teacher in primary/secondary schools.

The specification of the above-mentioned assessment areas was based on an extensive search of available domestic and foreign sources (Záhorec et al, 2021; Krátka, Gulová, Štřelec, 2020; Kadlečík, Munk, 2018; Freeman et al., 2014; O'Neill, Stephenson, 2011), on consultations with experts in the research area and, last but not least, on personal discussions conducted among the experts who have a wealth of professional and pedagogical experience in the field of primary, secondary, as well as continuing professional education of teaching staff in regional education within the educational disciplines on which our research focuses.

At the heart of any measurement process is the acquisition of data, which must be objective, reliable and valid. Since the questionnaire used for the purpose of our research was not standardized, but was created by us, we considered it necessary to validate it in terms of its reliability before using it.

4 Research Instrument Verification

The validity of the research instrument was assessed through its use in pilot research to assess its reliability, and to identify suspect items through reliability/item analysis. By analyzing reliability/items, we can increase the reliability of the questionnaire, or we can avoid using a poor-quality questionnaire through which the data obtained would have no meaningful value, no matter what advanced method we use to process it further. Verification of the questionnaire was carried out on a research sample of 12 secondary education teachers, with

a majority of females gender with different lengths of teaching experience. The pilot research sample of respondents was statistically sufficient, and therefore, it was possible to assess the reliability of the questionnaire and identify its suspect items using statistical methods.

Out of the total 89 items of the developed research instrument, 60 ordinal items grouped in 6 assessment areas (in the following part of the text referred to as areas *B* to *G*) were included in the statistical measurement for its verification process. In these items, teachers' attitudes towards the assessed aspects are measured using a five-point Likert scale ranging from 5 to 1.

A higher level of agreement with the statement is marked with a 4 (*rather yes = rather I have a need for further education in the activity*), and complete agreement is marked with a 5 (*yes = I have a need for further education in the activity*). A higher level of disagreement (*rather no = rather I have no need for further education in the activity*) with the statement made is indicated by a value of 2, complete disagreement (*no = I have no need for further education in the activity*) is indicated by a level of 1. The choice of a neutral, emotionally indifferent evaluative attitude towards questions B1 to B12 of the administered questionnaire is marked with a value of 3 (*neither yes nor no = I both have and do not have a need for further education in the activity*). For each respondent, the value of the scale was recorded for each ordinal item of the administered questionnaire according to the degree of positive or negative attitude towards the aspect under consideration.

The research data collection questionnaire was administered electronically. Teachers who completed this questionnaire had completed several innovation and updating programs/courses in their in-service training focusing on selected activities applicable to the intent of their practice as an elementary/secondary school form teacher on which the items of our research instrument focus. On this basis, we can consider the research sample to be representative and the self-assessment of the participating respondents to be relevant in terms of the focus of the research.

4.1 Results of the Pilot Questionnaire Survey

Descriptive statistics from the pilot questionnaire survey, processed in the form of box plots, are presented separately for each of the areas *B* – *G* of the survey for the entire research population without differentiation of respondents, i.e., without segmentation of respondents into groups based on any of the aspects asked through items A1 to A11 grouped in the introductory part of the questionnaire.

Based on the analysis of the responses obtained, box plots 1 to 6 summarise how the respondent teachers perceive the need for further training in selected agendas falling within the intent of a form teacher's educational and diagnostic activities in the primary/ secondary school.

Based on the analysis of the responses received, box charts 1 to 6 summarise how the teachers interviewed perceive the need for further training in selected agendas falling within

the intent of the educational and diagnostic activities of the form teacher in the primary/secondary school.

The box plots (1 to 6) visualise the median, quartiles (upper and lower quartile ranges), and variance (the interval within which the individual response values of the variable of interest range) in the ratings of each item in a given assessment area. This means that we can see the most critical quantiles in the graph, namely the minimum and maximum observed values, the lower (25th percentile) and upper quartiles (75th percentile), and the median of the scale (50th percentile).

From the range of variation, i.e., the interval in which the individual values of the responses to the variable under study range, we can see that the choice of the five-value scale was correct, given that respondents used the full range of the scale for their responses to the individual items. From the quartile range (i.e., the middle 50 % of the values), we can see the different variability of the responses to each item.

A set of six box plots visually represents teachers' ratings across different areas of the questionnaire. Box Plots 1 and 2 illustrate ratings for individual items in Areas B and C, respectively. Box Plots 3, 4, 5, and 6 detail teachers' ratings for items in Areas D, E, F, and G. These visualisations offer a concise yet comprehensive overview, enhancing interpretability and facilitating insightful analysis of diverse educational dimensions.

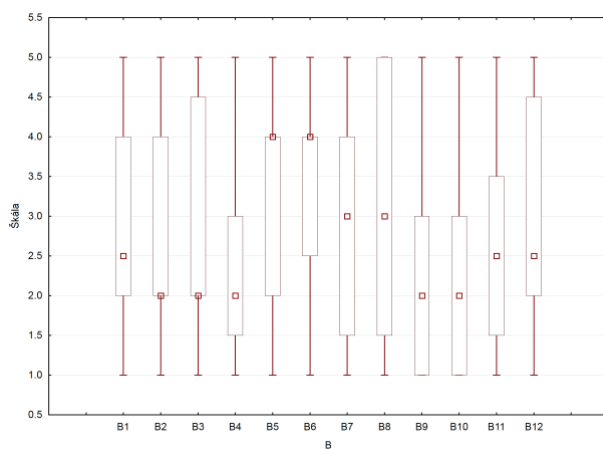


Figure 1: Box plot – visualisation of the differences in the scores of the individual items in questionnaire area B.

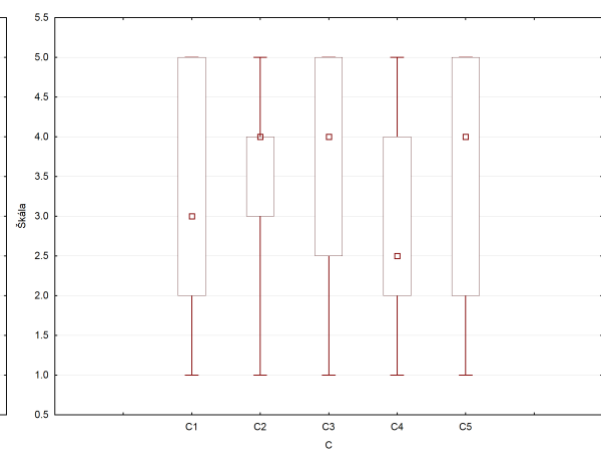


Figure 2: Box plot – visualisation of the differences in the scores of the individual items in questionnaire area C.

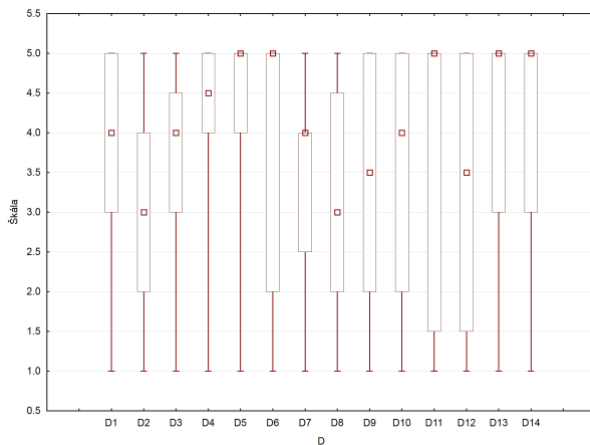


Figure 3: Box plot – visualisation of the differences in the scores of the individual items in questionnaire area *D*.

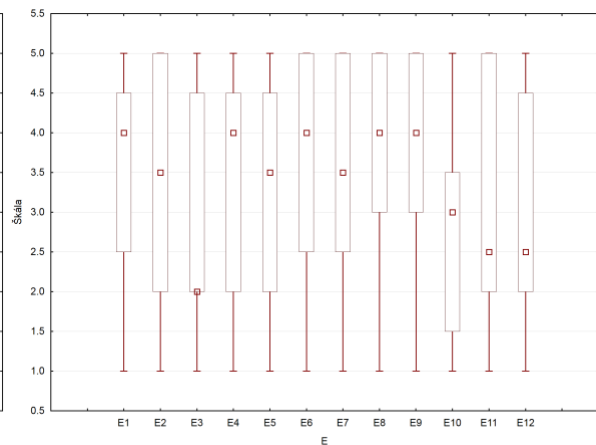


Figure 4: Box plot – visualisation of the differences in the scores of the individual items in questionnaire area *E*.

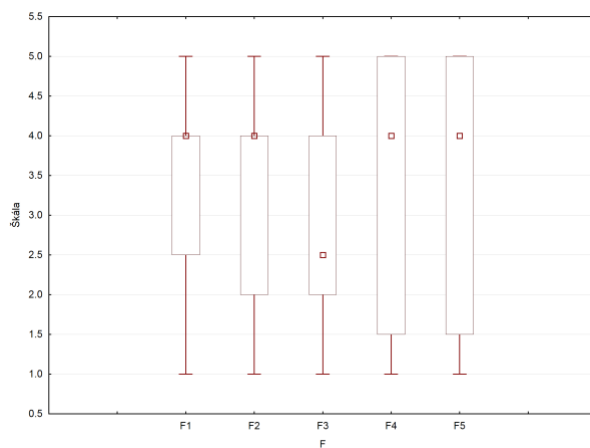


Figure 5: Box plot – visualisation of the differences in the scores of the individual items in questionnaire area *F*.

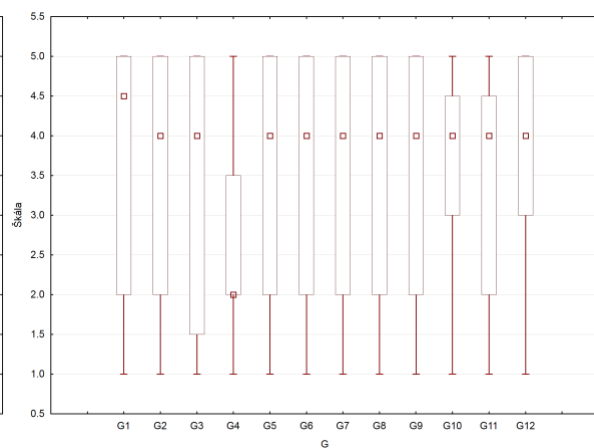


Figure 6: Box plot – visualisation of the differences in the scores of the individual items in questionnaire area *G*.

In order to assess the reliability of the measurement instrument used, after receiving the research data from the research sample of the respondents – form teachers of primary schools / secondary schools – we evaluated its internal consistency, which is an indicator of the targeting of the items to the area under study. Based on the conducted item analysis, we wanted to identify both possible suspicious items in the tested areas *B – G* of the questionnaire, which would reduce its overall reliability, and the items that had the most significant impact on the variability of the overall score of the used research instrument.

We consider it a positive finding that suspect items of the questionnaire that would reduce its internal consistency were identified only within the tested area *B* (B1 – B12). No suspect items were identified in the other areas *C* to *G* that would reduce its overall reliability. This fact, therefore, argues in favour of internal consistency among the items in tested areas *C – G* of the questionnaire. A large ($r > 0.5$) to very large ($r > 0.7$) positive correlation was overwhelmingly identified between the items in the tested areas *C – G* – a directly proportional linear relationship between the items and the total do-test score.

The correlation matrix of the test items from area *B* of the questionnaire is presented in Table 1 using a colour map. In this case, suspect items are those with independence or very low positive correlation (grey, < 0.2), independence or negative correlation between items (red, > -0.2), or low positive correlation (pale blue, < 0.4) has been identified. Conversely, blue-red indicates a positive correlation (> 0.4), which argues in favour of the targeting of those items to the area of interest.

The results of the statistical validation of the reliability of the research instrument are presented in Section 4.2.

Table 1: Correlation matrix of the items of the monitored area *B* of the questionnaire.

	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12
B1	1.0000	0.1951	0.6278	0.2306	0.4332	0.5264	0.7483	0.4583	0.4507	0.2072	0.4185	0.5028
B2	0.1951	1.0000	0.4264	0.7679	0.4599	-0.0188	0.3965	0.5550	0.4537	0.3435	0.3241	0.4946
B3	0.6278	0.4264	1.0000	0.4873	0.8250	0.5199	0.9197	0.7159	0.5666	0.2720	0.3870	0.7052
B4	0.2306	0.7679	0.4873	1.0000	0.4916	0.1876	0.4123	0.4856	0.4213	0.7360	0.5510	0.5719
B5	0.4332	0.4599	0.8250	0.4916	1.0000	0.6580	0.6479	0.6962	0.6620	0.3268	0.3742	0.7069
B6	0.5264	-0.0188	0.5199	0.1876	0.6580	1.0000	0.3915	0.4190	0.5277	0.2964	0.3915	0.5074
B7	0.7483	0.3965	0.9197	0.4123	0.6479	0.3915	1.0000	0.7825	0.5469	0.3268	0.4030	0.7344
B8	0.4583	0.5550	0.7159	0.4856	0.6962	0.4190	0.7825	1.0000	0.7807	0.4861	0.3903	0.9037
B9	0.4507	0.4537	0.5666	0.4213	0.6620	0.5277	0.5469	0.7807	1.0000	0.4453	0.1471	0.8556
B10	0.2072	0.3435	0.2720	0.7360	0.3268	0.2964	0.3268	0.4861	0.4453	1.0000	0.6679	0.5627
B11	0.4185	0.3241	0.3870	0.5510	0.3742	0.3915	0.4030	0.3903	0.1471	0.6679	1.0000	0.3226
B12	0.5028	0.4946	0.7052	0.5719	0.7069	0.5074	0.7344	0.9037	0.8556	0.5627	0.3226	1.0000

Legend to Table 1: $r \geq$ -1 -0.80 -0.60 -0.40 -0.20 0 0.20 0.40 0.60 0.80

From the correlation matrix of the questionnaire items, we can see (Table 1) that between most of the items of the study area *B*, the value of the correlation coefficient $r > 0.4$, from which we can conclude that there is a certain degree of interdependence between these items (the more the correlation coefficient approaches the value of 1, the stronger is the directly

proportional dependence). This indicates a positive correlation between the items, which favours the internal consistency of the questionnaire's domain of interest.

The exceptions are items B2, B4, B7, B10, B11 and B12, which do not correlate with some of the other questionnaire items, from which we can conclude that the values vary independently (Table 1). A low positive correlation (correlation coefficient $r < 0.4$) and a very low positive correlation (correlation coefficient $r < 0.2$) were identified between some items in domain B of the questionnaire, respectively. There is a negative correlation ($r < 0$) between items B2 and B6, i.e., the values change together but in the opposite direction (while the values of one variable decrease, the other variable increases). Based on these results, we identify items B2, B4, B6, B7, B10, B11, and B12 as suspects.

4.2 Results of the Reliability Item Analysis of the Developed Research Tool

As part of the testing, we also applied a multidimensional exploratory technique, namely reliability/item analysis of the developed research instrument. Tables 2 to 5 visualise the results obtained from the above analysis.

The reliability of the research instrument we developed was confirmed by assessing it and identifying suspect items through reliability/item analysis. The overall reliability of the questionnaire in the above six areas of inquiry, i.e., in terms of items B1 to B12 (area B), C1 to C5 (area C), D1 to D14 (area D), E1 to E12 (area E), F1 to F5 (area F) and items G1 to G12 (area G) was assessed using Cronbach's alpha coefficient, the standardised reliability coefficient and the correlation coefficient. Finally, the questionnaire was modified in its final form according to the comments identified.

The reliability coefficient value of 0.99 (99 %) reflects the proportion of the sum of the variability of the scale items to the total variability of the questionnaire. Both estimates (Cronbach's alpha and standardised alpha) are the same, indicating high internal consistency of the questionnaire items (Table 2).

Table 2: Summary statistics of the questionnaire.

	Valid N	Mean	Standard deviation	Average inter-item correlation	Cronbach's alpha	Standardised alpha
Summary for scale:	12	197.3330	75.1197	0.7285	0.9922	0.9922

The questionnaire can be considered highly reliable regarding the above group of items. However, the average correlation between the items (0.7285) indicates that the reliability of the constructed research instrument could be further increased after post-tensionally removing some items or modifying them.

Item reliability analysis of the validated research instrument confirmed the results of the data exploration, where the most suspect items reducing the overall reliability of the

questionnaire were identified in survey area *B*, in which we asked teachers through the items to what extent they perceived the need for further training in the stated administrative activities associated with the job of a form teacher in a primary/secondary school (Table 3). Another area of testing in which suspicious items of the administered questionnaire were identified was area *F*, through the items which we asked teachers to what extent they perceived the need for further education in the area of pedagogical diagnosis falling within the intent of the job description of a form teacher (Table 4). The final area of the pilot testing of the research instrument in which suspect items were identified was area *D*, in which we asked teachers through items to what extent they perceived a need for further training in the educational activities listed above falling within the remit of a form teacher in a primary/secondary school (Table 5).

On the other hand, we are pleased to note that the results of the do-questionnaire verification confirmed that query areas *C*, *E* and *G* do not show any suspicious post-items that would reduce the overall reliability of the developed research instrument. These are items focusing on teachers' self-reflection on the need for further training in the area of coordination of the primary/secondary school classroom in which they form teachers (area *C*), as well as items focusing on teachers' need for further training in the area of communication and collaboration of the classroom teacher with other actors, such as with the school administration, with other pedagogical and professional staff of the school, with pupils and their legal representatives, or with representatives of different institutions and organisations (area *E*). The area of inquiry, through the items of which we ascertained from teachers how they perceived their need for further training in selected preventive activities related to the job description of a form teacher in primary/elementary school, was also the area (*G*), which after testing did not show any post-suspicious items reducing the overall reliability of the developed research instrument.

Based on the above, in the next section of the paper, we will focus on a more detailed statistical analysis of the partial results of the reliability assessment of the items within the inquiry areas *B*, *D*, and *F* of the administered research instrument, i.e., those areas within which suspect items of the administered research instrument were identified.

4.2.1 Analysis of Suspicious Items in Questionnaire Area B

The data tabulation (Table 3) approximates the statistics of the area *B* questionnaire after removing the relevant item for the entire research population of respondents without differentiating them according to individual segmentation factors.

Table 3: Area B questionnaire statistics after removal of relevant items.

Statistical indicator / evaluated item	Mean if deleted	Standard deviation if deleted	Item-total correlation*	Alpha if deleted**
B1	194.4167	70.9712	0.7532	0.992136
B2	194.6667	71.4217	0.3935*	0.992447**

B3	194.5000	70.8267	0.7442	0.992147
B4	195.0000	71.2659	0.5194*	0.992339**
B5	194.1667	70.8012	0.7942	0.992095
B6	193.9167	71.1354	0.6575*	0.992218**
B7	194.5000	70.8549	0.7554	0.992133
B8	194.2500	70.7532	0.7226*	0.992184
B9	195.0000	71.0176	0.6523*	0.992231**
B10	194.4167	70.7407	0.8162	0.992073
B11	194.6667	71.0954	0.5950*	0.992286**
B12	195.0833	71.1928	0.5285*	0.992347**

Legend to Table 3: * < average correlation between items; ** > Cronbach's alpha

B1 – the agenda related to the interim and final assessment of pupils' performance; B2 – agenda related to the record of pupils' achievements; B3 – agenda related to the assessment of the pupils' behaviour and the granting of educational measures; B4 – agenda related to school attendance; B5 – agenda related to the form teacher's reporting obligation; B6 – agenda related to the teaching of pupils with SEN; B7 – agenda related to the preparation of documents for the meetings of the pedagogical council; B8 – agenda related to the organization of joint class activities; B9 – agenda related to the distribution and registration of textbooks; B10 – agenda related to the Covid-19 pandemic; B11 – agenda related to class meetings and parent associations; B12 – other agenda (informed consent, questionnaire for parents about personal data, class fund...); D5 – cooperation of the form teacher with experts in solving problematic behaviour of pupils; D4 – cooperation of the form teacher with parents in solving problematic behaviour of pupils; F2 – preparation of the interview, its implementation and data evaluation; F4 – preparation of sociometry, i.e. j. diagnosis of social relations between students in the classroom, its implementation and data evaluation; F5 – other pedagogical diagnostics (e.g. test, scaling).

The mean values of the total questionnaire score after removing the item, the standard deviation values, the correlation values between the item and the total questionnaire score, and the reliability coefficient values are reported.

Measurement using the scale showed (Table 3) that six items – B1, B3, B5, B7, B8, B10 from area *B* of the administered research instrument correlated with the total score of the scale and the reliability coefficient – Cronbach's alpha (0.9922) decreased after removing them. We observe the opposite situation for the remaining items, i.e., B2, B4, B6, B9, B11 and B12; in these cases, the reliability coefficient (Alpha if deleted) increased.

From the pilot testing of the research instrument, it is noteworthy, among other things (Table 3), that for items B2, B4, B6, B9, B11, and B12, reducing the overall reliability of the questionnaire, the correlation between the respective item and the overall score of the questionnaire (Itm-Totl Correl.) shows smaller values than the average correlation between items (0.7285). For the second item (B2), identified as suspect through the correlation analysis of the items of the research instrument, we observe the lowest correlation with the total questionnaire score (0.3935*) among all the items of area *B* tested. At the same time, the reliability coefficient increased the most after its removal (0.9924**). An interesting finding is that for the eighth item (B8), as in the case of items B2, B4, B6, B9, B11, and B12, a lower correlation value with the total questionnaire score (0.7226*) than the average correlation between items (0.7285) was observed. However, after its removal, the reliability coefficient remained almost unchanged (0.99218**). This means that items B2, B4, B6, B8, B9, B11, and B12 correlate but are below average with the total scale score of the questionnaire, which

leads us to conclude that the values vary independently. Based on these results, these items have been identified as suspects; for the remaining items, i.e. B1, B3, B5, B7, and B10, an above-average correlation was identified – a proportional linear relationship between the items and the total questionnaire score.

It is evident from the tabulation of the data (Table 3) that the overall resulting standard deviation (Standard deviation if deleted) values of the respondents' responses to items B1 to B12 were not extremely different. For all the tested sub-items of area B of the questionnaire, we observe a phenomenon where the value of Standard Deviation (75.1197) decreased when the respective item was deleted. The smallest decrease in standard deviation is observed just for items B2, B4, B6, B9, B11 and B12, reducing the overall reliability of the questionnaire. In terms of this statistical indicator, the most homogeneous responses were recorded for item B2 (standard deviation after removing item B2: 71.4217), where the variability of the total questionnaire score decreased the least after its removal. This is the item in which we investigated the response of primary/elementary school teachers to the need for further training in the agenda related to recording pupils' school achievements.

Scaled measurement showed that after removing any of the items B1 – B12 of the research instrument's area B, the mean score of the questionnaire (Mean if deleted) dropped. The most noticeable drop in the value of this statistical indicator can be seen for item B6 (193.9167). Through their responses to this item, primary/elementary school teachers were positive about the need for further training in the agenda related to the teaching of pupils with special educational needs. Along with this statement, it should be added that the respondents' answers for this item were among the most homogeneous among the items B1 to B12 (Figure 1).

4.2.2 Analysis of Suspicious Items in Questionnaire Area D

Through the items of the questionnaire's fourth (D) area, we ascertained the teachers' needs for further training in educational activities falling within the scope of a form teacher's responsibilities in the primary/ secondary school. Table 4 presents the questionnaire statistics of area D after removing the relevant item for the entire research population of respondents without distinguishing them according to each segmentation factor.

Table 4: Area D questionnaire statistics after removal of relevant items.

Statistical indicator / evaluated item	Mean if deleted	Standard deviation if deleted	Item-total Correlation*	Alpha if deleted**
D1	193.6667	70.6757	0.9048	0.991989
D2	194.4167	70.7689	0.9167	0.991992
D3	193.7500	70.6141	0.9451	0.991949
D4	193.0833	71.2197	0.6397*	0.992232**
D5	193.0000	71.2367	0.6148*	0.992251**
D6	193.5833	70.4680	0.8842	0.992003
D7	194.0000	70.6694	0.9534	0.991950
D8	194.1667	70.6810	0.8812	0.992010

D9	193.9167	70.5378	0.8892	0.991997
D10	193.8333	70.4969	0.9148	0.991969
D11	193.7500	70.3777	0.8775	0.992018
D12	194.0000	70.5065	0.8546	0.992038
D13	193.4167	70.4467	0.9490	0.991931
D14	193.4167	70.4467	0.9490	0.991931

Legend to Table 4: * < average correlation between items; ** > Cronbach's alpha

D1 – agenda related to the solution of problem behaviour of pupils in the school environment; D2 – agenda related to the solution of problem behaviour of pupils in the school environment; D3 – agenda related to the support of the school in solving problem behaviour of pupils; D4 – agenda related to the cooperation of the form teacher with parents in solving problem behaviour of pupils in the school environment; D5 – agenda related to the form teacher's co-working with professionals in addressing problem pupil behaviour in the school environment; D6 – agenda related to the application of methods aimed at maintaining pupil discipline in the school classroom; D7 – agenda related to documents used in addressing problem behaviour and pupil discipline in the school classroom; D8 – agenda related to the application of appropriate consent to desirable pupil behaviour in the school environment; D9 – agenda related to the acceptance of pupil personality and individuality; D10 – agenda related to the choice of appropriate communication between classroom teachers and pupils in the school classroom; D11 – agenda related to creating a favourable climate among pupils in the school classroom; D12 – agenda related to minimising the use of negative/punitive assessment of pupils; D13 – agenda related to promoting pupils' teamwork in the educational process carried out in the school; D14 – agenda related to promoting pupils' self-development.

Measurement using the scale showed (Table 4) that twelve items – D1, D2, D3, D6 to D14 from area *D* of the administered research instrument correlated with the total score of the scale and after removing them, the reliability coefficient – Cronbach's alpha (0.9922) decreased. For the remaining two items, i.e., D4 and D5, we observe the opposite situation; in these cases, the reliability coefficient (Alpha if deleted) increased.

From the pilot testing of the research instrument, it is noteworthy, among other things (Table 4), that for items D4 and D5 reducing the overall reliability of the questionnaire, the correlation between the respective item and the overall score of the questionnaire (Itm-Totl Correl.) shows smaller values than the average correlation between items (0.7285). For the fifth item (D5), identified as suspect through the correlation analysis of the items of the research instrument, we observe the lowest correlation with the total questionnaire score (0.6148*) among all the items of area *D* tested. At the same time, the reliability coefficient increased the most after its removal (0.9923**). This means that items D4 and D5 do not correlate with the total scale score of the questionnaire, from which we can conclude that the values vary independently. Based on these results, these items have been identified as suspects. For the remaining items, i.e. D1, D2, D3, D6 to D14, a positive correlation – a directly proportional linear relationship between the items and the total questionnaire score was identified.

It is evident from the tabulation of the data (Table 4) that the overall resulting standard deviation (Standard deviation if deleted) values of the respondents' responses to items D1 to D14 were not extremely different. For all the tested sub-items of area *D* of the questionnaire, we observe a phenomenon where the value of Standard Deviation (75.1197) decreased when

the respective item was deleted. The smallest decrease in standard deviation is observed for the aforementioned items (D4, D5) reducing the overall reliability of the questionnaire. In terms of this statistical indicator, the most homogeneous responses were recorded for item D5 (standard deviation after removing item D5: 71.2367), where the variability of the overall questionnaire score decreased the least after its removal. This is the item in which we looked at the responses of primary/ secondary school teachers on their need for further training in the agenda related to the form teacher's co-working with professionals in dealing with pupils' problem behaviours in the school setting.

Scaled measurement showed that when any of the test items D1 – D14 of area *D* of the research instrument were deleted, the mean score of the questionnaire (Mean if deleted) decreased. The largest drop in the value of this statistical indicator is noticeable for item D5 (193.0000). Through their responses in this sub-item, the primary/secondary school teachers expressed their positive opinion about the need for further training in the area of a form teacher's cooperation with professionals in dealing with problem behaviours of pupils in the educational process. At the same time with this statement, it should be added that the respondents' answers for this item were among the most homogeneous among the items D1 to D14 (Figure 3).

4.2.3 Analysis of Suspicious Items in Questionnaire Area *F*

Through the items of the sixth (*F*) part of the questionnaire, we ascertained the teachers' needs for further training in the field of pedagogical diagnostics falling within the scope of the form teacher's job description. Table 5 presents the statistics of the area *F* questionnaire after removing the relevant item for the entire research population of respondents without differentiating them according to each segmentation factor. Table 5 approximates the area *F* questionnaire statistics after removing the relevant item for the entire research set of respondents without differentiating them by individual segmentation factors.

Table 5: Area *F* questionnaire statistics after removal of relevant items.

Statistical indicator / evaluated item	Mean if deleted	Standard deviation if deleted	Item-total Correlation*	Alpha if deleted**
F1	193.9167	70.9277	0.7488	0.992138
F2	194.1667	70.9000	0.7228*	0.992165
F3	194.4167	70.7419	0.8511	0.992040
F4	193.9167	70.8501	0.6613*	0.992252**
F5	194.0000	71.0141	0.5254*	0.992431**

Legend to Table 5: * < average correlation between items; ** > Cronbach's alpha

F1 – agenda related to the concept of design and development of the questionnaire, its administration and evaluation of the data obtained; F2 – agenda related to the preparation of the interview, its implementation and evaluation of the data obtained; F3 – agenda related to the preparation of the post-survey, its implementation and evaluation of the data obtained; F4 – preparation of the sociometry, i.e. F5 – other pedagogical diagnostics (test, scaling...).

The measurement using the scale showed (Table 5) that three items – F1, F2, F3 from area *F* of the administered research instrument correlated with the total score of the scale and after removing them, the reliability coefficient – Cronbach's alpha (0.9922) decreased. For the remaining two items, i.e., F4 and F5 we observe the opposite situation, in these cases the reliability coefficient (Alpha if deleted) increased.

From the pilot testing of the research instrument, it is noteworthy, among other things (Table 5), that for items F4 and F5 reducing the overall reliability of the questionnaire, the correlation between the respective item and the overall score of the questionnaire (Itm-Totl Correl.) shows smaller values than the average correlation between items (0.7285). For the fifth item (F5), identified as suspect through the correlation analysis of the items of the research instrument, we observe the lowest correlation with the total questionnaire score (0.5254*) among all the items of area *F* tested. At the same time, after removing it, the reliability coefficient increased the most (0.9924**). An interesting finding is that for the second item (F2), as in the case of items F4 and F5, a lower correlation value with the total questionnaire score (0.7228*) than the average correlation between items (0.7285) was observed. However, after its removal, the reliability coefficient remained almost unchanged (0.99216**). This means that items F4 and F5 do not correlate with the total scale scores of the questionnaire, from which we can conclude that the values change independently. Based on these results, items F2, F4, and F5 have been identified as suspects. For the other two (F1, F3), a positive correlation – a directly proportional linear relationship between the items and the total questionnaire score – was identified.

It is clear from the tabulation of the data (Table 5) that the overall resulting standard deviation (Standard deviation if deleted) values of the respondents' responses to items F1 to F5 were not extremely different. For all the tested items of area *F* of the questionnaire, we observed a phenomenon where the value of Standard Deviation (75.1197) decreased when the respective item was deleted. In terms of this statistical indicator, we observe the smallest decrease in the variability of the overall questionnaire score for the fifth item (F5), reducing the overall reliability of the questionnaire (standard deviation after removal: 71.0141). This is the item in which we monitored the response of the interviewed primary and secondary school teachers of primary/ secondary schools to the need for further training in the agenda of further pedagogical diagnostics (such as test and scaling) applicable to the intentions of their educational activity.

Scaled measurement showed that after removing any of the research instrument's F1 – F5 area *F* test items, the mean score of the questionnaire (Mean if deleted) decreased. The most significant drop in the value of this statistical indicator is seen for items F1 and F4 (193.9167), respectively. Through their responses in these items, the primary/secondary school teachers held a positive opinion about the need for further training in the concept of designing and developing a do-questionnaire or in activities related to the application of the diagnostic method of socio-metrics, their administration in the context of obtaining research data, and the subsequent processing and evaluation of the data obtained in this way. At the same time,

with this statement, it should be added that the respondents' answers for item F1 were among the most homogeneous among the inquiry items F1 to F5 (Figure 5).

5 Next phases of the Research Survey

In the next phase of the research survey, a random selection of subjects into a representative sample was carried out. The final version of the author's questionnaire was distributed electronically to form teachers working at ISCED 2 and ISCED 3 in Slovakia and the Czech Republic. Coding, digitisation, and data analysis are currently in progress. In near future, the research findings will be interpreted, and conclusions will be formulated, which will form the basis for the creation of the main outputs of the project (university textbook, web portal). These outputs will be content-compatible, while the web portal will be supplemented with multimedia visuals and textual elements. Both outputs will be created as part of a battery of didactic materials, which could help especially in the undergraduate training of students at universities, as well as form teachers in practice, to orient themselves in the stated activities (agenda) of a form teacher (areas B – F) to form and develop their professional competences.

Acknowledgment

This work was supported by the Grant Agency for Culture and Education of the Ministry of Education, Science, Research and Sport of the Slovak Republic under the project No. KEGA 066UK-4/2021 and by the Science Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic under project No. VEGA 1/0213/23.

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Specific Issues in Teaching Consumer Psychology and Marketing Communication in the Context of New Challenges and Information Literacy

Jana Kollár Rybanská¹, Katarína Krpáľková Krelová², Filip Tkáč³

DOI: <https://doi.org/10.53349/resource.2024.is1.a1272>

Abstract

In recent years, we have been increasingly confronted with misinformation, hoaxes, and harmful, artificially created fake news. Negative socio-economic developments (including the COVID-19 pandemic, the war in Ukraine, and the Israeli-Palestinian conflict) and their ensuing consequences (societal polarisation, heightened aggression, distrust, and a generally hostile atmosphere) have created a fertile breeding ground for their proliferation. Misinformation and disinformation also challenge the teaching of consumer psychology and marketing communication. One of the primary reasons for this is the alarming trend of people rejecting scientific knowledge, losing trust in scientists and doctors, and turning to alternative sources of information. This scepticism extends to various aspects, including climate change, European Union policies, and other matters. From the consumer psychology standpoint, this represents a significant concern, as disinformation directly hinders the realisation of sustainable development goals outlined in the 2030 Agenda. This paper aims to underscore the specific challenges in teaching modern consumer psychology and propose novel pedagogical approaches that simultaneously enhance information literacy.

Keywords: Consumer psychology, Marketing communication, Information literacy, 2030 Agenda, Sustainable development goals

¹ PhDr. Mgr. Jana Kollár Rybanská, PhD., DTI University, Ul. Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovak Republic

E-Mail: jana.rybanska@uniatq.sk

² Assoc. prof. Ing. Mgr. Katarína Krpáľková Krelová, PhD., ING-PAED IGIP, Prague University of Economics and Business, nám. W. Churchilla 1938/4, 130 67 Praha 3 – Žižkov, Czech Republic

³ Ing. Filip Tkáč, PhD., DTI University, Ul. Sládkovičova 533/20, 018 41 Dubnica nad Váhom, Slovak Republic

1 Changes and New Challenges of Consumer Psychology and Marketing Communication

Consumer psychology and marketing communication are two dynamic fields that have the greatest impact on consumer behaviour in the market for products and services. They are subject to constant change and are developing rapidly. The greatest challenge for consumer psychology is the discrepancy between consumerism and anti-consumerism, also reflected in new teaching strategies.

Consumerism, characterised by an excessive preoccupation with consumption, has permeated various aspects of modern life. In a consumerist paradigm, individuals' attention centres on acquiring goods and services, driven by the belief that our lives are merely a sequence of problems resolvable through personal responsibility and professional solutions. This mindset equates life management with running a small business, emphasising the pursuit of material acquisitions to address perceived deficiencies (Rischins & Dawson, 1992; Shaw & Aldridge, 2003; Stearns, 2006; Consumer Society, 2021). Nowadays, society is stuck in a state where we are constantly flooded with information, and it is impossible to maintain distance from marketing communication tools that promote and increase consumption. As disseminators of information, the media (television, radio, newspapers, and online media) are occupied by commercial advertisements, which leads to an unstoppable flow of commerce into society. Individuals seek their identity, purpose, and meaning of life by purchasing a particular product, which is significantly supported by the commercial activity of various institutions and implemented through the media (Hasyim, 2017; Mladá, 2021).

Marketing communication, particularly promotional techniques, profoundly influence consumer opinions and behaviour by shaping the emotional landscape of their decision-making process. Decades of research have revealed that many factors, including personality traits, temperament, psychological tendencies, social dynamics, cultural norms, societal expectations, and others, sway purchasing decisions. However, the cornerstone of consumer behaviour lies in the interplay of personality psychology, prior experiences, and emotional engagement (Fazio et al., 1982; Higgins, 1996; Clegg, 2001; Fitzsimons et al., 2002; Fazio & Olson, 2003; Jain & Posavac, 2004; Krishna et al., 2004; Dijksterhuis et al., 2005; Jacob et al., 2011; Singh & Verma, 2017; Jaeger et al., 2018; etc.).

This is confirmed by over 400 billion dollars spent worldwide advertising each year. If marketing communication, especially advertising, did not work, companies would never spend such high sums on marketing activities. Hand in hand with such a massive sphere of influence should go the responsibility for what consumer behaviour marketing communication creates or strengthens because it is the only way to a long-term sustainable society and environment (Paulík, 2021).

Fashion trends and rapid technological development primarily drive consumer society. Products quickly morally wear out and go out of fashion before they stop working. Consumers do not buy new things because they need them but because they want them, even though

the "old" could still serve them reliably. The average lifespan of products (until the purchase of a new one) is shortening; for example, for clothing, it is one year; for mobile phones, it is about two years; we buy cars for about 4 years, and so on. The result of consumer society is excessive waste generation, including food waste (Fišerová et al., 2018).

The key to long-term to permanent sustainability is, therefore, a gradual transition to anti-consumerism. Anti-consumerism is a trend that represents the opposite of consumerism. It focuses on reducing excessive consumption and waste production, reducing factors damaging the environment, promoting quality over quick and easy profit, and regulating unethical business. As a socio-political ideology, anti-consumerism challenges the notion of limitless consumption and the pursuit of material possessions. It serves as a counterpoint to materialism, often associated with consumerism's emphasis on acquiring and accumulating wealth. While materialism promotes amassing material possessions, anti-consumerism rejects such behaviour. However, complete rejection of consumption is not feasible, as material goods are essential for our existence. Therefore, instead of using the term "anti-materialism," which implies a complete denial of material needs, the term "anti-consumerism" is more appropriate to convey the opposition to excessive and wasteful consumption (Fišerová et al., 2018). For instance, an anti-consumerist approach to clothing purchases would involve considering real needs, reducing shopping frequency, making thoughtful purchasing decisions, and opting for second-hand clothing when necessary. An extreme anti-materialist, on the other hand, might even choose to own no clothes at all. For most consumers in developed countries, an important consumption goal is to achieve a sense of happiness. It is, therefore, an interesting finding that materialism, that is, the belief that the acquisition of material products is the main source of happiness and life satisfaction, is, in fact, associated with reduced subjective well-being.

A study on the relationship between anti-consumerism and subjective well-being was conducted in 2016. Since anti-consumerism counters materialism, and materialism exhibits a negative association with well-being, the hypothesis posited a positive impact of anti-consumerism on subjective well-being. The findings unveiled a growing inclination among consumers to pursue behaviours that enhance their subjective well-being. For instance, they increasingly prioritise experiences like trips, sightseeing tours, and skydiving over material possessions. Furthermore, consumers who align with anti-consumption values are more likely to engage in environmentally conscious behaviours (Lee & Ahn, 2016).

1.1 Specific Issues of Consumer Psychology and the 2030 Agenda for Sustainable Development

Anti-consumerism is gaining increasing prominence through consumers and the influence of governments, municipalities, non-profit organisations, various institutions, and, notably, the media. A growing portion of society recognises the detrimental effects of our prevalent

lifestyle, not just on the environment but also on the quality of life and social interactions (Binkley & Littler, 2011).

The following trends also emerge from the ideas of anti-consumerism:

- Green marketing,
- Corporate social responsibility (CSR),
- Zero-waste or low-waste lifestyle
- Support of local producers and service providers,
- Shared economy,
- Sustainability and reduction of food waste,
- Environmental protection,
- Experiential marketing,
- Social marketing,
- Partnership marketing.

One of the primary roles of consumer psychology and marketing communication today should be to contribute to protecting the environment and the sustainable development of life on Earth. Sustainability and sustainable development are inextricably linked to the environment and environmental problems. Sustainability is currently a concept that we encounter daily in the most diverse areas of our lives. We read about sustainability problems in newspapers and books, we hear about them in the news and speeches of local and foreign politicians and various associations and organisations, we monitor the behaviour of small and large businesses, which often confuse marketing campaigns with corporate social responsibility, we watch shows, movies and series inspired by environmental problems, we monitor the gradual emergence of "green" stores and "green" consumers, gradual changes in our shopping behaviour, in short, sustainability problems and environmental problems are now an integral part of our daily lives.

We have been aware of environmental concerns for quite some time. We are not just grappling with the notion of sustainability; we are also confronted with many frequently discussed issues: global warming, climate change, melting glaciers, water, ocean, and air pollution, excessive waste production, greenhouse effect, environmental damage, and others. Whether we lean towards the theory that humans directly contribute to climate change or to the notion that it is only an indirect influence, one thing we cannot deny is that by our activities and everyday functioning, we damage or contribute to the damage of the environment.

At the end of November 2019, the European Parliament declared a climate emergency in the European Union. We are undeniably facing various interconnected environmental challenges that have and will have consequences for the lives of (not only) people around the world (Ivanegová, 2020).

Efforts to protect the environment and raise awareness of sustainability issues have been turbulent. In 1983, the United Nations established the World Commission on Environment and Development, which focused on environmental problems. This commission, also known

as the Brundtland Commission, published a report in 1987 entitled *Our Common Future* (Ivanegová, 2020). It deals with the problem of economic development that can be sustainable without destroying non-renewable natural resources and the environment. This report, which politicians and environmental experts prepared, contains the first and most frequently quoted definition of sustainable development: „Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs “(WCED, 1987).

36 years have passed since the publication of the Brundtland Report, which means that the future that the report is talking about is happening now. Many activists and researchers are, therefore, rightly asking why we are still discussing sustainability and doing so little to reverse the unfavourable development. The answers are not easy to find; the current situation is probably closely linked to developed countries' lifestyles and how the current generation is educated. Although more and more people are aware of the need to protect the environment and deal with environmental issues and sustainability, many people turn a blind eye to the current situation, or it does not seem severe enough to them. They are unwilling to change their lives or give up at least part of their comfort.

For decades (since the 1980s), the United Nations has been leading the way in addressing environmental issues and promoting sustainable practices. World leaders met in New York in September 2000 and agreed to work together to fight poverty and achieve essential goals by 2015. These goals, called the Millennium Development Goals, aimed to make the world a better place for everyone (UN, 2015).

In 2015, the 2030 Agenda for Sustainable Development was adopted at a special UN summit in New York. It sets a general framework for countries worldwide to eliminate poverty and achieve sustainable development by 2030. It is based on the Millennium Development Goals of 2000 and builds on them. The UN's 2030 Agenda for Sustainable Development is the most comprehensive set of global goals for achieving sustainable development to date. The fundamental principles of the 2030 Agenda are transformation, integration, and universality (UN, 2015).

There are seven years left to achieve the 17 Sustainable Development Goals. The Social Progress Index (2020) report (Green et al., 2020) states that if the current trend does not change, the goals will not be achieved before 2082. The COVID-19 pandemic further delays achieving the goals by one decade to 2092, meaning a delay of more than 60 years.

Several experts are concerned about whether we can achieve the goals of the 2030 Agenda. They call for radical changes in primary, secondary, and tertiary education. They believe our inability to address the worsening environmental problems stems from the fact that entire generations have been led to unsustainability, even within education. For example, they cite the excessive use of plastic bags (recently available in supermarkets and stores for free) and plastic packaging, excessive use of private vehicles, a consumerist lifestyle, excessive consumption of fast food, and more (Urenje, 2021).

The task of education in consumer psychology and marketing communication, and the disciplines themselves, is the theoretical and practical implementation of knowledge by the 2030 Agenda.

1.2 The Fragile Bond between Consumer Psychology, Marketing Communication, and Information Literacy

In recent years and months, we have been increasingly exposed to fake news, misinformation, disinformation, and conspiracy theories. The COVID-19 pandemic, the war in Ukraine, the Israeli-Palestinian conflict, and the rapid development of social media and artificial intelligence have created fertile breeding ground for the spread of all sorts of unsubstantiated claims and information, especially in the online space. In the past few years, many studies have tried to explain why even educated persons with higher-than-average intelligence are susceptible to believing unsubstantiated information. Respondents of many of these studies were teachers, and the results are alarming (e.g., Kowalski & Taylor, 2009; Swami et al., 2011; Ballová Mikušková, 2018; Čavojová et al., 2020). In our research, we found out that vocational teachers, like the rest of the population, are susceptible to believing hoaxes, misinformation, and disinformation, and they cannot distinguish between facts and opinions (Kollár Rybanská, 2023).

Current research offers several explanations for why people believe in unsubstantiated information, the most common of which are:

1. Confirmation bias - people tend to seek information that supports and confirms their existing beliefs and ignore information that contradicts them. When, for example, disinformation coincides with someone's beliefs and worldview, there is a high probability that they will believe it because they will not be inclined to verify the information further. Search engine algorithms also support confirmation bias. This phenomenon was intensively studied in the 1990s (e.g., Kunda, 1990; Nickerson, 1998).
2. Lack of critical thinking or underdeveloped critical thinking - some people may have insufficient ability to think critically, or they may not have/have not had the opportunity to develop their critical thinking, because of which they cannot assess the credibility of the information they encounter. They cannot recognise the so-called "red flags" or assess the credibility and reliability of sources (Yaqub et al., 2014; Wineburg & McGrew, 2019).
3. Emotional appeals - some disinformation may contain emotional appeals (e.g., injured or dead people or animals, attacks on human dignity, negative emotional stimuli such as anger, fear, sadness, crying, despair, suffering, etc.), which affect a person's mood and emotional experience in a similar way to marketing communications.

4. Trust in authorities - in the 1980s, research showed that people are more likely to believe information presented by an authority. This phenomenon is also known as the "halo effect".
5. Lack of information literacy or lack of information - there are many examples of hoaxes and false information that persist in societies and communities where access to accurate information is limited (e.g., in authoritarian regimes) (Marcellino et al., 2021), or recipients do not have sufficiently developed information literacy for various reasons.

Consumer psychology delves into understanding consumer behaviour and the factors that influence their purchasing decisions. Now, we know that if we can reach consumers' emotions and evoke an emotional response, we can be sure to arouse their attention and interest. Many people have lower emotional stability and higher levels of empathy, so messages with emotional appeals can convince recipients very quickly (Ghanem et al., 2018).

The main task of consumer psychology and marketing communication in the context under study is to provide consumers with enough information about the functioning of the market and the promotion of products so that they can make the right decisions on the market, to be able to see the background of marketing communication techniques, to be not easily deceived, and to be able to assess the quality of the offered products and services reliably.

Information literacy encompasses finding, evaluating, and using information effectively. It empowers individuals to make informed decisions, solve problems, and participate actively in society. The connection between information literacy and consumer psychology lies in their shared goal of promoting informed decision-making. Information literacy equips consumers with the skills to navigate the vast sea of information, enabling them to critically assess the credibility and relevance of sources before making choices. Similarly, consumer psychology sheds light on the psychological factors that shape consumer behaviour, helping individuals understand how perceptions, emotions, and motivations influence purchasing decisions.

2 New Challenges in Teaching of Consumer Psychology and Marketing Communication

Simply put, it can be said that the teaching of consumer psychology and marketing communication has always been mainly about helping students understand how the decision-making process works and how emotions influence our purchasing behaviour in the products and services market. The importance of informed decision-making has always been emphasised. Today, we are in a situation where even educators themselves have problems distinguishing between true and false information. This raises the question of how to teach students how to work with information correctly when educators themselves often cannot do so. The situation is further complicated by negative social and economic development

and the rapid development of social media. Information literacy should be developed in conjunction with internet literacy.

Modern consumer psychology studies how people think, feel, and behave in the marketplace. It is a complex and ever-changing field, but several problems have been identified mainly in recent years.

One problem is that consumers are increasingly flooded with information. This can lead to information overload, making it difficult for consumers to make informed decisions. Additionally, the information consumers are exposed to is often biased or misleading, which can further confuse them. Another problem is that consumers are impulsive, primarily because of the limitless possibilities of shopping and social media, which make it easier than ever to make purchases immediately. Additionally, consumers are often exposed to marketing promotions designed to trigger emotional responses, such as fear, movement, or excitement, which can further cloud their judgment.

Finally, consumers are increasingly susceptible to manipulation. This is because they are often unaware of marketers' psychological techniques to influence their behaviour. They are often motivated by emotions, such as greed or envy, making them more susceptible to persuasion. These problems can have several negative consequences for consumers and for the whole society. For example, they can lead to overspending, impulse purchases, and even addiction. They can also make consumers more susceptible to fraud and scams.

We formulated three fundamental new problems that influence the education process in consumer psychology and marketing communication:

- The rise of misinformation and disinformation: The quick reproduction of online information sources has made it difficult for consumers to distinguish between credible and misleading information. Misinformation and disinformation can significantly impact consumer behaviour, leading to irrational decisions, harmful purchases, and social polarisation and unrest. Consumer psychology educators play a crucial role in understanding how misinformation spreads and developing strategies to promote media literacy and critical thinking skills among students.
- The rise of Artificial Intelligence (AI): AI rapidly transforms the consumer landscape, influencing everything from product recommendations to personalised marketing campaigns. While AI offers potential benefits, it raises concerns about manipulation, privacy, and algorithmic bias. Educators in the field of consumer psychology need to teach students how to work with AI and develop frameworks for responsible AI implementation.
- The rise of consumer groups that reject scientific knowledge relates to the rise of misinformation and disinformation that has many reasons (from essential effort to sell scams to hybrid war efforts). Social media also strengthen the formation of groups of consumers without sufficient education in specific fields of knowledge (law, medicine, physics, etc.) who are, on the other hand, very confident and are susceptible to falling for hoaxes and disinformation. Consumer psychology educators

play a crucial role in developing strategies to promote social media literacy among students.

- Addressing these new problems in consumer psychology requires a multidisciplinary approach, combining insights from psychology, marketing, sociology, and data science. By understanding the challenges and opportunities presented by these emerging trends, consumer psychologists and educators can contribute to a more informed, responsible, and sustainable consumer landscape.

3 Conclusion

Consumer psychology constantly evolves as new technologies, societal trends, and consumer behaviours emerge. Several new challenges in recent years require consumer psychologists and educators to adapt their research practices and educational methods.

Consumers are more susceptible to believing hoaxes, misinformation, and disinformation because, as research has shown, it depends not so much on intelligence and education but probably on other factors we must uncover. Subsequently, a three-year study will be conducted to monitor personality characteristics, mental health, life satisfaction, and other psychological, personality, and socioeconomic factors that could explain why we are susceptible to unsubstantiated beliefs. Suppose we succeed and uncover the factors that influence the tendency of people to believe hoaxes. In that case, we can set better, more targeted, and addressed education not only in consumer psychology and marketing communication.

We presume that algorithms and heuristics, such as specific scenarios of procedures, organising thinking and problem-solving for more efficient and rational work, could also help teach consumer psychology and marketing communication.

“DITOR” heuristics (Zelina, 1996) (English acronym = DICEI) appears as the best procedure for teaching and learning in the field of consumer psychology and marketing communication. DICEI procedure:

D – define = A good definition of the problem can help the basic understanding of the topic.

I – inform = find information, study many sources, and compare them. Do not forget to inform yourself about the authors of the information (Are they scientists? What do we know about them?).

C – create solutions = creative work, cooperation with others, brainstorming, buzz groups, etc.

E – evaluate = evaluate not only acquired solutions but also information and authors of information (if you already did it in step 2, do it again).

I – implement = concrete projects and realisation of solutions.

We believe it is essential to focus not on lecturing theory but on involving students in solving real-world problems. We should move to a teaching system where students study the materials independently and then use their acquired knowledge to solve the tasks set in class, like how it works at universities such as Harvard and Yale.

Teaching should also emphasise verifying information. It is no longer enough to verify only the information itself but also the authors from whom we obtained the information. It is crucial to determine whether they are scientists, teachers, or otherwise relevant authors, their reputation in their field, and how the established professional community accepts them.

Recent years have shown us that avoiding alternative media and opinions is not good. On the contrary, we should incorporate them into the educational process and show how disinformation works, how it spreads, and how we can identify it. Argumentation should be an integral part of consumer psychology and marketing communication.

Acknowledgements

The presented paper is the outcome of the project KEGA 030SPU-4/2022, „Implementation of selected goals of 2030 Agenda in Consumer Psychology education – Production of multimedia e-textbooks and web-based platform for the higher education“, solved at the University Counselling and Support Centre of Slovak University of Agriculture in Nitra.

This article is one of the outputs of the research project of institutional support at Prague University of Economics and Business IP100040.

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Eigentümerin und Medieninhaberin:
Pädagogische Hochschule Niederösterreich
Mühlgasse 67, 2500 Baden
www.ph-noe.ac.at | journal.ph-noe.ac.at

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2024 by Pädagogische Hochschule Niederösterreich
ISSN 2313-1640

Die vierte Ausgabe von **R&E-SOURCE** im 11. Jahrgang des Journals widmet sich dem Thema
wissen schaffen.lernen

Einreichungen sind bis 31. Juli 2024 herzlich willkommen unter
<https://journal.ph-noe.ac.at/index.php/resource/about/submissions>
Erscheinungsdatum: 15. Oktober 2024