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System of preparation of pupils in technical education and its application in school practice

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Abstract

The authors present a system of education of pupils in the technical field within secondary education in Slovakia. They focus on the subject Technique, its position in the state educational program and the ensuing foundations of the development of technical thinking, creativity and knowledge of environmental aspects related to technique. They confront the state-required preparation of primary school graduates with the real experience of pupils entering the first years of secondary vocational schools. In the conclusion, they consider possible solutions to the identified situation.

System zur Vorbereitung von Schülern im technischen Unterricht und dessen Anwendung in der Schulpraxis

Zusammenfassung

Die Autoren Show ein System zur Schulbildung von Schülern im technischen Bereich der Bildung im Primarbereich und Sekundarbereich Bildung in der Slowakei vor. Sie konzentrieren sich das Unterrichtsfach Technik, seine Stellung im staatlichen Bildungsprogramm und die sich daraus ergebenden Grundlagen für die Entwicklung des technischen Denkens, der Kreativität und des Wissens über technikbezogene Umweltaspekte. Sie konfrontieren die staatlich geförderte Vorbereitung von Grundschulabsolventen mit der realen Erfahrung von Schülern, die in die ersten Jahre der beruflichen Sekundarstufe eintreten. Abschließend betrachten sie mögliche Lösungen für die identifizierte Situation.

Keywords:	*Schlüsselwörter:*
subject Technique	Unterrichtsfach Technik
state educational program	staatliches Bildungsprogramm
school educational program	schulisches Bildungsprogramm
technical education	technische Ausbildung
practical working habits	praktische Arbeitsgewohnheiten

1 Introduction

The generally accepted rule is that the country is as rich as its educated and healthy inhabitants. Therefore, well-prepared graduates living in a safe and healthy environment are the starting point for the company's wealth. The authors of the paper are aware of the current challenges of today, typical of the globalization of the economy, which, however, it brings more environmental threats, technological risks and labor migration.

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With the rapid development of science, technology and especially information and communication technologies, approaches to people's values, lifestyles and ways of communication are changing more and more quickly than they have been in the recent past.

Children of primary and secondary education spend more time alone with their electronic devices - smartphones, tablets and computers. They are the means by which they know quickly obtain basic information from various areas. They have rather developed cognitive abilities.

Compared to the recent past, the threat that the 21st century brought in Slovak conditions is little interest of children in manual work, the associated weaker working habits and poorly developed psychomotor skills, which the authors of the paper also consider an important prerequisite for employing school´s graduates in their another productive life.

And how their prepared by the Slovak education system and teachers in secondary education?

2 Development of technical thinking, creativity and environmental awareness of pupils in the school system of the Slovak republic

The authors of the paper focused on the prerequisites for the development of technical thinking of pupils, their creativity and awareness of the environmental context within secondary education in Slovakia. In order to develop the above-mentioned competencies, education of pupils is realized through the second level of elementary schools (lower secondary education) and secondary and secondary vocational schools using this two-level model:

1. *State educational program* (SEP) - defines educational standards of provided education for relevant subjects at the target, performance and content levels - school can serve as a curriculum of compulsory subjects.
2. *School educational program* - based on SEP, it is created by specific school. (SEP, 2008)

According SEP (2008) the educational standard consists of the characteristics of the subject and the basic learning objectives that are specified in the performance standard. It is a coherent system of performance, which is expressed by cognitively graduated concrete goals - learning requirements.

These basic requirements can be further specified and developed by teachers in the form of other close learning objectives, learning tasks, questions or test. The defined performance is associated with a content standard, with keys words of the internal structure of learning content. The curriculum is structured according to individual thematic units. It is the basis of defined learning content.

Part of the SEP was the Framework curriculum (SEP-FC, 2008) for primary schools with the Slovak language of instruction valid from 9/2009, which in the educational area "Man and the World of Work" specified only one lesson per week in one of the 5.-9. years of elementary school.

The school had available (available) lessons to complete the school educational program, which it could add to broaden and deepen the content of the subjects included in the state curriculum, such as the subject Technique. (SEP-FC, 2008). Therefore, the actual number of lessons of individual subjects within school curricula could differ.

The last elementary school graduates according to this SEP came to the first year at secondary schools in the current school year 2O19 / 2020.

Since 9/2015, the innovated SEP has been in force, where in the Framework curriculum (SEP-FC, 2015) for elementary schools with the Slovak language of instruction in the educational area "Man and the World of Work", the subject of Technique has a 1 hour per week in each year of lower secondary education, i.e. the subject Technique is in the 5th to 9th grade.

Primary education is followed by secondary and secondary vocational schools, where vocational education and training is defined by Act No 61/2015 Z. z. as follows: “In secondary and secondary vocational schools the vocational education and training pupils acquires the knowledge, skills and competences necessary for the exercise of a profession, a group of occupations or the pursuit of professional activities; it is divided into theoretical teaching and practical teaching. Practical teaching is an organized process providing pupils with the practical skills, abilities and habits necessary for the feat of a profession, group of occupations or professional activities”.

Forms of Practical Teaching According Act No 61/2015 Z. z.:

- vocational training - it is organized as a vocational subject of an apprenticeship or study field, of at least 1 400 teaching hours for the entire duration of the study, training is conducted under the guidance of a Master of Professional Education or instructor,
- vocational practice - is organized as a professional subject of study field. vocational practice is conducted under the guidance of a vocational, a Master of Professional Education, principal instructor or instructor,
- practical exercise - is organized as a separate vocational subject or as part of a vocational subject other than vocational training and vocational practice. Practical exercises are conducted under the guidance of the teacher of the relevant vocational subject.

Vocational training or vocational practice performs by the pupil in the workshop, at the employer's workplace or in the practical training workplace if the pupil is trained in a dual education system. The practical exercise is performed by a pupil in a secondary vocational school. Where required by the nature of the exercise work, the exercise may also be carried out at the workplace of the employer or at the workplace of practical training. (Act No 61/2015).

From the above it is clear, that in secondary vocational school pupils already work in a real working environment. For active activity of elementary school´s graduates in practical training in workrooms of secondary vocational school or at the employer's workplace, the authors consider it important their of the technical readiness, the use and handling of tools, working with machines and instruments, as well as knowledge of the rules of safe work.

3 Teaching of subject Technique

Subject Technique according SEP-Technique (2009) is included in the educational area Man and the World of Work in the State Education Program. This area focuses on practical work habits and complements the entire basic education with an important component necessary for the employment of man in further life and in society. It is based on creative cooperation of pupils. The educational content of the course Technique (SEP-Technique, 2009) consisted of thematic units until the school year 2018/2019:

- Man and technique
- Graphic communication
- Materials and technologies
- Electricity
- Technique - household - safety

Performance standards have been set for these thematic units, from which we choose:

Pupils have:

a) Know the basic types of technical materials
b) Be able to correctly transmit the shape and dimensions of the object from the drawing to the material to be machined, select the gauges and contouring aids correctly.
c) Be able to work according to simple technological procedure and technical drawing.
d) Know and distinguish the basic types of technical materials - wood, metals, plastics.
e) Know the basic tools for manual processing of wood, metal and plastics.
f) Practice (depending on the possibilities and equipment of the school) and acquire individual elementary skills in working wood, metals and plastics (filing, drilling wood, bending plastics and sheet metal, cutting, cutting wire and sheet metal).
g) To know the basic battery power sources and accumulators.
h) Being able to read simple electrical symbols (diagrams and wiring) and be able to connect simple electrical circuits to the electrical engineering kit for elementary schools.
i) Know the basic wiring material, its function and use (switches, plugs, sockets, light bulbs, fuses and circuit breakers).
j) Know the function and become familiar with the main parameters and the correct use of basic household electrical appliances.
k) Be able to describe the production and distribution of electricity and know the ecological aspects of electricity production.
l) Know the importance of the electricity meter and get acquainted with examples of calculation of electricity consumption.
m) Familiarize yourself with modern electrical household appliances.
n) Know the rules of safe work with electric current.
o) Be able to provide first aid in case of electric shock.

For the development of environmental awareness of pupils, the authors consider to be an important the content standard of thematic unit Technique - Household - Security. Its content focuses on basic information in the field of residential installation - heating, hot and cold water distribution, overall household and energy saving, environmental aspects and low maintenance in the home. Its performance standards include:

a) To get acquainted with the central heating system in apartments and its function.
b) Be able to describe the system of hot and cold water distribution in the apartment.
c) Know the composition and function of the simple faucet (battery).
d) Familiarize yourself with the repair of the toilet flushing system.
e) To know the possibilities of saving heat and hot water and at the same time ways of preventing heat leakage - ways of insulating windows and doors.
f) Be able to describe the principle of combustion in heating installations - central heating. Know the calculation of energy consumption for heating.
g) Repair the faucet (battery) leak by replacing the gasket, milling the seats or replacing the valve inserts. Technique. (SEP-Technique, 2009).

All this should be known by pupils after completing the subject Technique at primary school.

4 Survey real status

The authors decided to find out by means of a questionnaire survey based on six simple items the current state of preparedness of primary school graduates from the subject Technology for further vocational education of pupils at secondary vocational schools in Trnava self - governing region. On the sample of 123 pupils of the first year of the selected SOŠ, the following findings were made.

The first item of the questionnaire identified the location of schools within the region; they were pupils from 63 primary schools from 3 self - governing regions, while 45% of pupils attended primary schools in the villages, other pupils attended primary schools in cities.

The second item was to find out how many years of lower secondary education the same pupil took part the subject of Technique. We consider it serious that as many as 15 % of pupils reported that they did not have a subject Technique at all in lower secondary education; on the contrary, 5% of the survey respondents stated that they had a subject Technique in every grade of lower secondary education. The premises in which the subject of Technique was taught were determined by the third item and are shown in Figure 1:

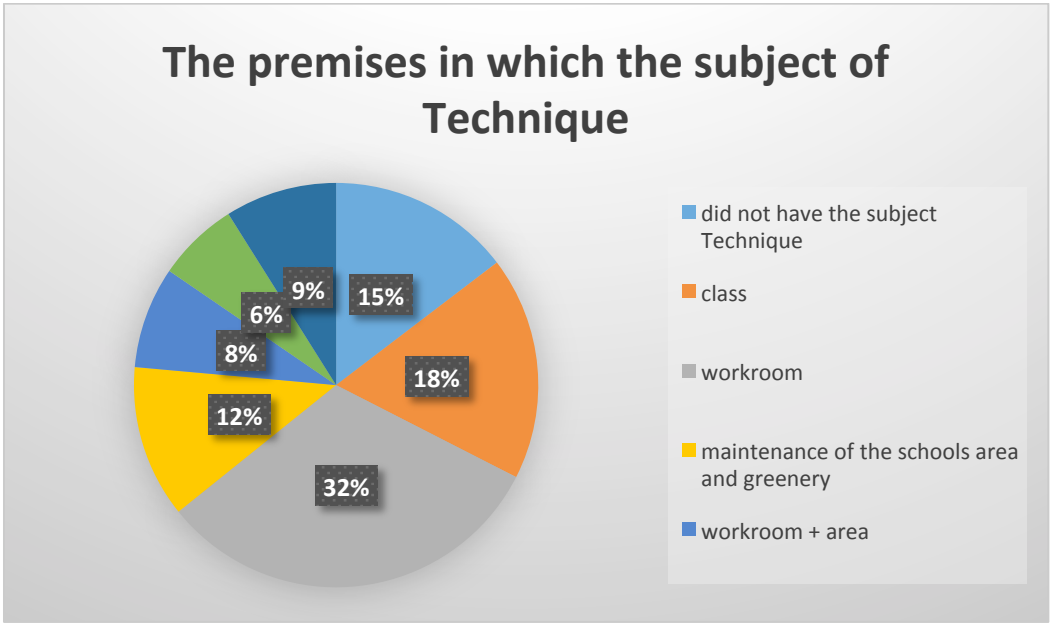

Fig. 1: The premises in which the subject of Technique

The fourth item of the questionnaire was to find out what tools and instruments pupils used in the Technique lessons. 33 % respondents said they did not use any tools and instruments, 20% used only garden tools and only 4 % of pupils were working with machine machining.

In the fifth item, 52 % of the pupils stated that they did not produce any their own products on the technique lessons, shown in Figure 2.

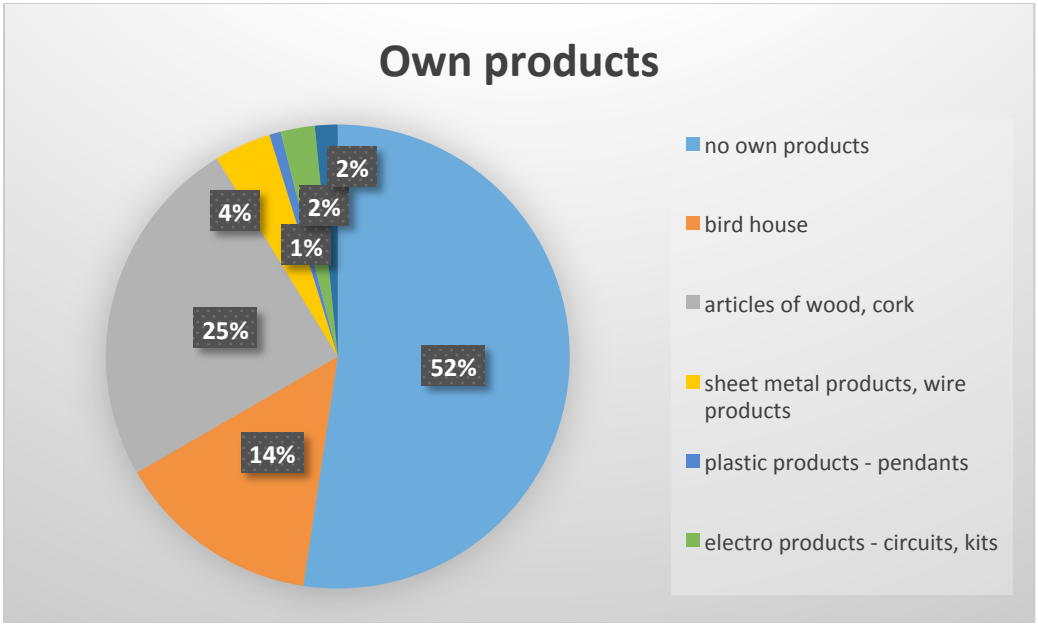

Fig. 2: Own products of pupils made on lesson of Technique

In the last item, focusing on environmental aspects related with technique and technology in teaching subject Technique, 55 % respondents replied that they had not learned at all and another 8 % did not remember what they were learned.

5 Conclusion

The analysis of the data revealed that the preparation of pupils for technical thinking, for acquiring basic work skills and habits, for using appropriate tools and instruments at primary schools in the monitored region is low. Technical preparation of pupils in some schools is confused with the maintenance of school premises, care for greenery. The mutual collaboration of teachers between primary and secondary schools is questionable and pupils come to the vocational secondary schools technical poorly prepared or completely unprepared in the technical field.

Despite the fact, that current elementary school pupils learn the subject of Technique every year of lower secondary education according to an innovated state curriculum, industrious graduates with well-developed psychomotor skills can hardly be expected if the responsible elementary school staff behave as they do so.

Considering to the answers of our respondents, we also think that in many schools the human factor fails, especially the focus and activity of teachers. The activity of teachers, their motivation but also the motivation of pupils is likely to be changed only by a generational exchange of pedagogical and some managers. A motivated teacher who leads by example can also motivate his pupils. If the teaching elements are prescribed in the SEP and too in the school educational program, these elementary school employees are supposed to fulfil them.

Improving the identified situation will require increased efforts and education of teachers in the technical field, their cooperation with pupils' legal representatives so that school graduates are better technically prepared for their further study and productive life and know the principles of observing safety and environmental rules in their work.

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