

# New Trends in E-learning and New Approaches to the Development of E-learning Educational Materials

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## **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

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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).

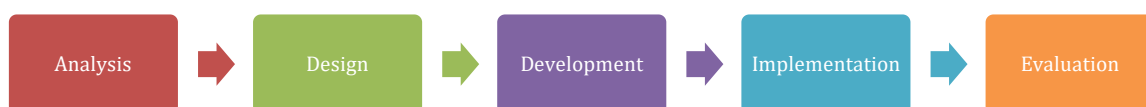


Figure 1: The traditional ADDIE Model (Source: authors)

*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.

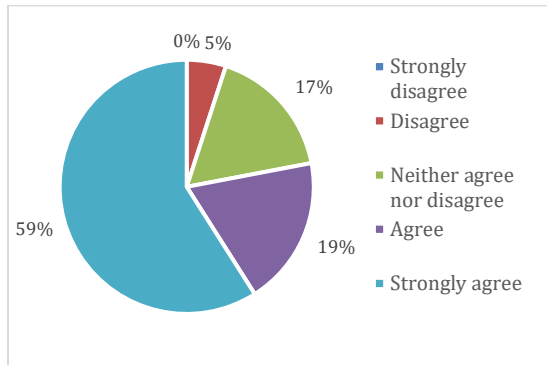


Chart 1: The teaching text in e-learning study material was formulated in a comprehensible way.

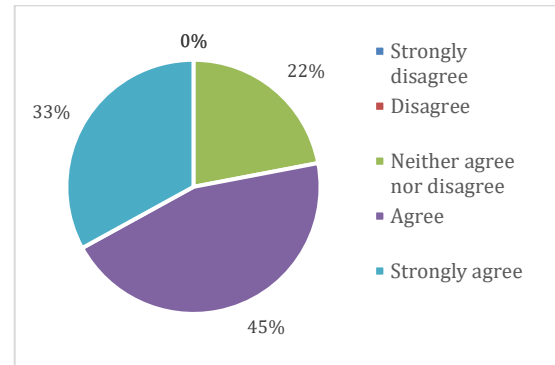


Chart 4: The e-learning study material platform featured user-friendly navigation and readily accessible information.

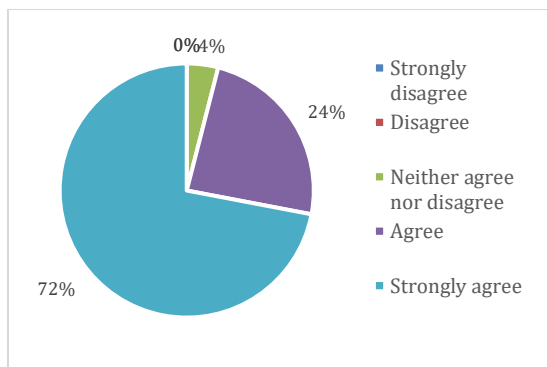


Chart 2: The utilisation of illustrative materials, including graphs, tables, and animations, enhanced my comprehension of the subject matter.

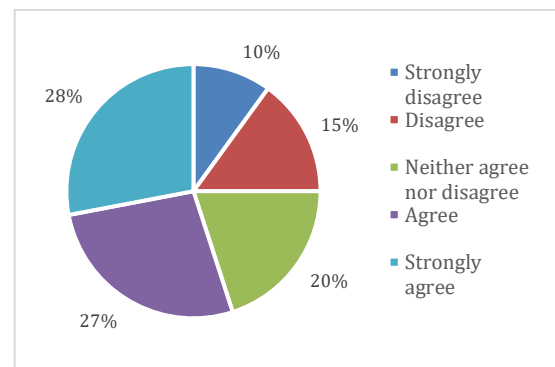


Chart 5: Were the examples given in the study materials sufficient for a thorough understanding of the subject matter?

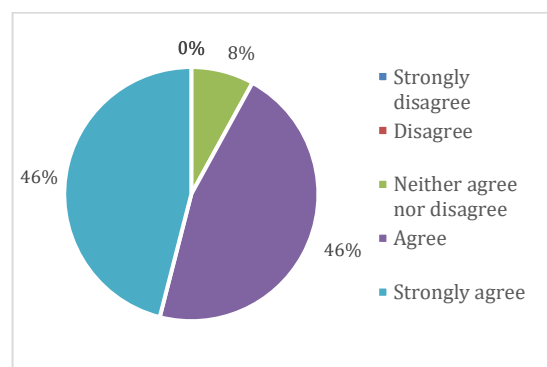
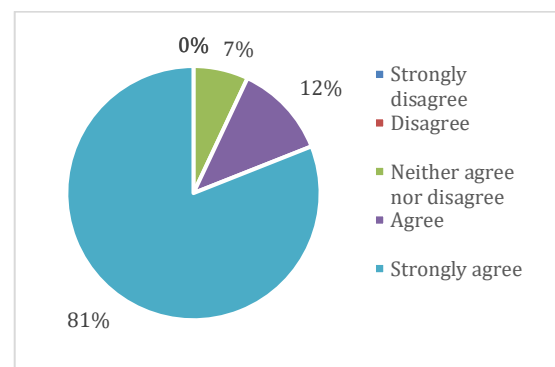


Chart 3: The self-tests made available in the study materials gave me good feedback on my progress in the study.



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.

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