

The Role of Artificial Intelligence in Educational Technologies for the Purposes of Higher Education – Experimental Research

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Abstract—This research focuses on the role of artificial intelligence in educational technologies in higher education. The modern vision and needs of current and future professions set new requirements for the training of future specialists related to the use and application of high-tech training resources. The relevance of the issues under consideration stems from the need to adapt the training to the modern requirements of professional practice. In Bulgaria, the application of artificial intelligence in higher education is developing rapidly, but there are areas where it is still in its early manifestation process. The purpose of this study is to analyze the development of educational technologies using artificial intelligence and to present the results of a pilot experimental study among students, aimed at upgrading the previously applied learning technologies by implementing artificial intelligence. The results of the experimental study show an increase in student motivation and learning efficiency using AI for learning purposes.

Keywords— artificial intelligence, educational technology, social work, training.

I. INTRODUCTION

In the era of new technologies in recent years, artificial intelligence has been rapidly establishing itself and has found application in numerous fields of professional practice. Several studies in recent years have attested to the implementation and use of artificial intelligence for the purpose of more effectively decision-making, demonstrating flexibility, and adapting to the new business and practical requirement. As Nikolova-Minkova points out “*people’s creativity has been a generator of their development and a prerequisite for high scientific and technical achievements, giving the appearance of modernity*” [1, p.243]

In the sphere of education, the interest of the impact and role of artificial intelligence is increasingly deepening and expanding, having in mind the unlimited possibilities that

AI provides. Several studies lay the foundation for numerous models generated in administration, educational technologies, and the use of training tools and resources. As Chain et al. point out, artificial intelligence enables the enhancement of teachers’ effectiveness and efficiency, makes possible the personalized approach to students, based on their needs and requirements, and consequently improves the quality of learning [2].

The term “*artificial intelligence*” has become firmly established in both the research and applied aspects of education. Globally, UNESCO, through the Education 2030 Program, seeks to promote a human-centered approach to AI, with the main priority of making innovative AI technologies accessible to all, while adhering to the principles of equality and inclusion [3]. Several regulatory documents provide guidance for the use of AI in educational sector. Their main objectives are to promote high-quality digital education and training [4], to develop digital competences through the creation of AI learning resources [5], and to establish ethical guidelines for the use of AI for educational purposes [6]. In Bulgaria, trends and strategies in the educational sector regarding the implementation and use of artificial intelligence for the purposes of the educational process, are focused on modern digital infrastructure [7], [8], interactive learning, digital resources, teachers’ trainings [9].

The purpose of this study is to examine the development of educational technologies utilizing artificial intelligence and to present the results of a pilot experimental study focused on the application of artificial intelligence in the learning process.

The object of the current study is the artificial intelligence. The subject of research is educational technologies generated by artificial intelligence.

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In the theoretical part of the article, educational technologies using artificial intelligence are examined, having in mind their development, contribution, and innovation for the purpose of training future specialists in various fields of professional activity. The empirical part of the publication presents the results of a pilot experimental study to determine the significance and role of educational technologies using artificial intelligence in the education of students. Through the research methods used -such as analysis, synthesis, experimentation, statistical methods and tabular presentation of data-, an attempt is made to illustrate the role of artificial intelligence in educational technologies for the purposes of higher education. Concluding with the summary of the research finding of the conducted study and outlining the future challenges that higher education will face by introducing educational technologies with artificial intelligence in students' training, the article emphasizes the significance of artificial intelligence in educational technologies and the need to continuously improve and adapt the educational system to the opportunities provided by artificial intelligence.

II. MATERIALS AND METHODS

A. Literature review

The expectations and requirements that society makes regarding the process and conditions of training future specialists in different professional spheres have constantly evolved throughout history, they are currently changing and will continue to change dynamically. This implies changes in the organization, technology, and the process of education. In this context, viewed historically, education as a process- including the methods and tools used- undergoes through various transformations and is determined by the dynamics of technological progress at both national and international levels.

Historical and pedagogical research on the ideas of regarding the interaction between a teacher and a learner supports the thesis that at the center of effective learning is the question "how" – what educational technologies, what tools and methods are appropriate and suitable for the specific situation or learner. A review of the literature sources on the subject shows that even in the distant past, the use of innovative technologies for the purposes of human learning was related to people's needs for more accessible, easier, and faster learning.

For the purposes of the research, it is interestingly to consider the definitions of the concept of "educational technology" from the point of view of their evolutionary development through a brief historical overview.

The early years of the 20th century were marked by the development of innovative solutions that shaped educational technologies. Using technological innovations such as projectors, slides, films, and visual learning in schools become not only more enriched, but also more

accessible, emphasizing on the experiences rather than more mechanical memorization [10, p.37]. Between the 1960s and 1980s, educational technology integrated the complex relationships between the organizational and managerial context of learning and educational resources (people, techniques, tools, environment) to address learning challenges [11], [12], [13]. The following years marked an expansion of the scope of the definition of educational technology toward a systemic -process approach. By integrating ideas from various sources ("conceptual" technologies) the best learning environment is ensured [14], furthermore educational technologies promote "intellectual development" and "continuous learning ability" [15, p.13]. In the context of the systematic examination of educational technology, according to Khutorskoy, the technology of education is "*a set of consistent and dynamic alternation of specific goals, content, procedures (methods), means (techniques), organizational forms, control and evaluation mechanisms and criteria for comparability of goals and results*" [16, p.82]. Similarly, the conceptual understanding of educational technology proposed by Januszewski and Molenda includes the combination of elements of *research* (improving and upgrading knowledge by exploring of new problem areas), *ethical practice* (commitment to and alignment of one's own ethical and professional conduct), *facilitation* (supporting learning through appropriate environments, resources and tools), and *productivity* (the ability to utilize and apply new opportunities with a focus on individuality) [17]. The information age makes information more accessible, anywhere and at any time, but it necessitates the need for a higher level of information literacy.

The contemporary perspective on educational technologies implies the upgrading of definitions, according to [18], in the direction of student empowerment and inclusion, ethical integration of technologies and a learner-oriented environment [see Fig. 1]. The Association for Education Communication and Technology (AECT) defines educational technology as "*the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources*" [19, p.1]. In the cited article, the primary objective, highlighted in the definition, is learning and ethical practice, that is, the importance of teaching values, which is the focus and essence of educational technologies. The authors point out that the tools - means, resources, processes -are part of educational technology. The emphasis in the contemporary understanding of educational technology is also the concept, which is related to the inclusion and access to education for disadvantaged groups of the population. As Todino points out, educational technologies are key to ensuring equal access to learning and supporting the development of "*digital, cognitive, and critical skills, meeting the needs of a changing world.*" [20, p.1].

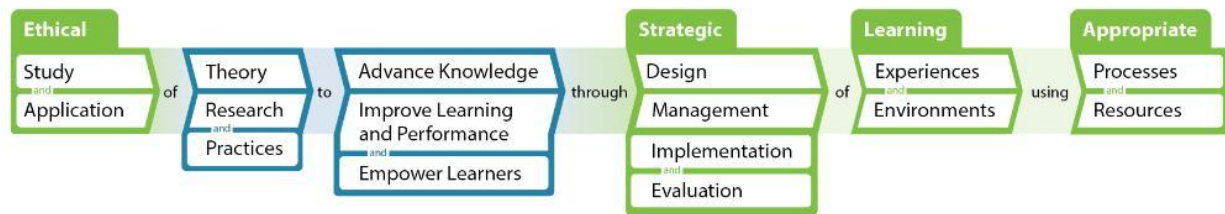


Fig. 1. Definition of educational technology [8, p.57]

Today, educational technologies are expanding the scope of their terminological interpretation, which is largely due to the development in recent years of technologies using artificial intelligence. The growing interest in researching the role, impact and implementation of artificial intelligence in various areas of the professional and educational spheres, reflects the significant role and place of innovative technologies and future projections for their development and implementation.

According to the generally accepted understanding, Artificial Intelligence (AI) is defined as a technology through which complex problems in specific situations can be solved. Most authors in recent years have accepted that definition artificial intelligence is complex and requires a more comprehensive examination not only in terms of the necessary skills, goals, tasks, and actions that artificial intelligence performs, but also a clearer understanding of the phenomena and processes that arise from its application [21], [22], [23]. The European Commission's High-Level Expert Group provides the following definition of artificial intelligence: "Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals" [24, p.1].

Similar to the periods of educational technologies development discussed above from a terminological perspective, here we examine the evolution and dynamics of the development of artificial intelligence in educational technologies. The early years (1950s-1980s) were marked by the emergence of the first AI concepts in education, which marked the beginning of Artificial Intelligence in Education (AIED). As early as 1950, Turing presented his concept of the "intelligent" aspect of systems by testing the ability to distinguish between a conversation with another person or a machine. According to him, if no such distinction is found, then an intelligent system (AI) is present [25]. Expert systems, adaptive and training programs such as PLATO (Programmed Logic for Automatic Teaching Operations), TICCIT (Time-Shared, Interactive Computer-Controlled Information Television) place the individual needs of learners [26], adaptability, and two-way interaction at the center of educational technologies and learning, and these implications remain relevant today. Over the next twenty years, the integration of more complex, intelligent education systems, the use of

analytical approaches and data-driven systems to improve personalization were observed. Since the year 2000, machine learning, large databases, and adaptive systems have evolved rapidly, and the field of AI research expanded. As Huang et al. points out, the focus is on the use of AI in learning technologies to support teaching, facilitate learning, "realize smart learning," through innovative smart resources such as virtual classrooms, adaptive learning, smart educational robots [27, p.207]. The accelerated pace of development and implementation of AI in educational technologies has been significantly influenced by the global Covid 19 pandemic. Due to epidemiological restrictions, educational institutions have switched to online learning and the use of digital resources, which require the adaptation and enhancement of knowledge, skills and competencies of both students and teachers. According to Vázquez-Cano, artificial intelligence in education in recent years can offer an opportunity to improve the quality of learning through a more sustainable model, in line with the recommendations of UNESCO's "2030 Agenda for Sustainable Development", by creating a more enriching and personalized learning environment, integrating AI into methods such as blockchain, gamification, conversational agents and others. [28, p.9]. The current stage of development and application of AI in educational technologies is determined by the outburst of research on generative AI, such as the GPT model, various hybrid models for human-machine learning, etc.

At the same time, significant attention is being paid to the ethics and social aspects of the application of AI in the educational environment. Today, the learning process and interaction between students and teachers is supported by the help of several innovative technologies generated with AI – Canva, virtual reality (VR) and augmented reality (AR), Microsoft Sway, etc. [29].

Based on a systematic review of publications between 2023 and 2024, Bang et al. note that unlike conventional digital educational tools, AI systems based on large language models (LLMs) provide the opportunity for interactive, adaptable, and personalized learning environments in real time [30]. Research in recent years has shown that the integration of ChatGPT and other AI Chatbot platforms into the educational process leads to an increase in motivation, engagement, and a higher degree of

personalization of students' learning [31]. The authors emphasize the contributions that AI tools have such as virtual academic assistant, automatic feedback, etc. At the same time, they point out that it is necessary to develop strategies to minimize shortcomings and change curricula in education in order to achieve a balance between knowledge, use and ethics [31, p.17]. The innovative capabilities of AI technologies are also manifested in their ability to change the pedagogical model from a teacher-centered to a learner-centered approach. Instead of inert perception of information and passive participation in the pedagogical situation, students actively interact with the system through an interactive form of organization of the educational process. This is in line with modern concepts of adaptive and personalized learning [32]. In addition, meta-analysis studies have found a positive effect on students' cognitive and non-cognitive skills, highlighting the innovative importance of AI technologies in improving academic achievement, autonomy, and student engagement [33]. Despite the positive results reported by recent meta-analysis, the researchers emphasize the importance of pedagogical control and responsible implementation of AI technologies to avoid overuse and superficial learning outcomes [34], [35].

In this context, the analysis of literature sources allows us to assume that the implementation of AI chatbot technologies in education can be perceived as an innovative approach that collaborates simultaneously personalization, automation, and interactivity in support of the development of modern educational practices. Current research shows that artificial intelligence in education has the potential to improve the learning process, but at the same time sets new requirements for the preparation of pedagogical models, digital literacy, and ethical standards in education.

Based on the literature review of the definition of the concept of “educational technology” and AI in educational technologies, the working definition that we adopt for the purposes of the study is as follows:

Educational technology is a purposeful process that is carried out in accordance with regulatory and ethical requirements, aimed at achieving educational goals, through the acquisition and development of competencies, using contemporary appropriate forms, methods and resources of training, with measurable results and systematic monitoring, influenced by the environment, learners and context (see Fig. 2).

B. Methodology of the research

The study used a quasi-experimental one-group pre-test/post-test design aimed at evaluating the educational effectiveness of simulated interaction scenarios supported by artificial intelligence in teaching social work students. The experimental approach was chosen due to the specific pedagogical context of social work education, where traditional teaching methods are mainly based on discussions, lectures, and theoretical case studies.

In the context of Bulgarian higher education in social work, the existing structure of the curricula is mainly focused on theoretical and disciplinary training. However,

opportunities for practical training and simulated professional interaction in the university learning environment remain relatively limited, especially with regard to the integration of interactive technologies supported by artificial intelligence.

The implemented AI-supported learning model introduced interactive scenario-based activities that allowed students to participate in simulated communication and decision-making processes. This represents an innovative pedagogical approach compared to conventional teaching.

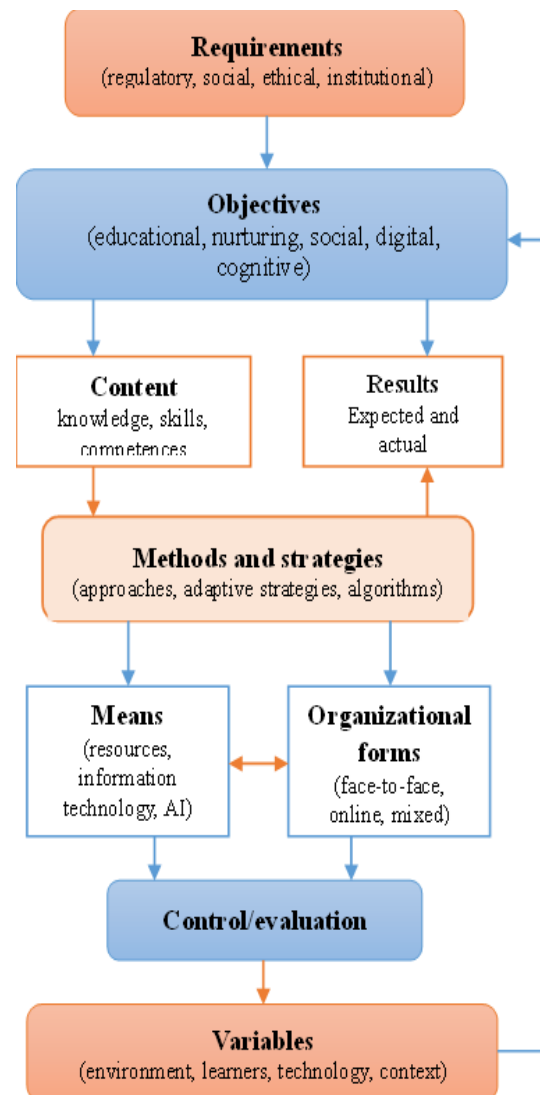


Fig. 2. Elements of educational technology [Own preparation]

The tasks by which we realize the purpose of the study are as follows:

1. To develop a training simulation method using AI for practical training.
2. To implement experiential learning by using a training simulation method with AI.
3. To analyze students' attitudes towards the new method of practical training.

The object of this experimental study is the training process for students majoring in “Social Activities” at the Technical University of Gabrovo, Bulgaria.

The subject of research is practical training using an AI-based simulation method as an innovative method.

The hypothesis of the study states: the implementation of AI-based simulation method in the practical training of students leads to statistically significant improvements in results and higher motivation.

The stages of the experimental study include:

1. Ascertaining stage, the purpose of which is to establish the initial level through the following methods: entrance test for knowledge and skills, survey for digital competence and motivation, observation.

2. Formative stage, the purpose of which is to apply a simulation method using artificial intelligence in the practical training of students.

3. Assessment stage, aimed at evaluating the impact of training, using the following methods: an exit test of knowledge and skills, structured in the same way as the entrance test; a survey of satisfaction and attitudes; comparative analysis of the results.

The experimental research methods used are single-group pedagogical experiment, a simulation based teaching method, knowledge and skills tests, questionnaires, observation, statistical analysis (t-test, Cohen’s d, percentage analysis).

The research was carried out in January 2026 among 15 students majoring in “Social Activities” at the Technical University of Gabrovo, Bulgaria. Students are in the third year, bachelor’s degree.

To collect the data necessary to test the hypothesis, we used the following tools:

1. A chatbot that we developed through the Soul Machines Ins platform and integrated into a training site created for the purpose of training students.

2. Entrance test to measure the students’ initial level of knowledge and counselling skills of students.

3. Survey to analyze the motivational component, digital readiness, and attitudes towards AI-based learning.

4. An exit test and a comparison survey with the baseline data, used to measure the cognitive effect, the development of counseling skills, the motivational effect, the perceived realism of the AI simulation.

Participants in the study take part voluntarily. All tools used are anonymized to ensure the protection of personal data and confidentiality.

III. RESULTS AND DISCUSION

We implemented the pilot study through a single-group pedagogical experiment with input and output measurement. Through knowledge and skills tests (Table

1) and digital competence and motivation surveys, we collected the necessary information for analysis.

By calculating the average, we determined the difference between the outgoing and incoming test (see Table 2), where $\bar{X}$ denotes the mean value and D shows the difference between the two tests.

The results show that after training by applying a simulation method with a chatbot, an increase of 8.34 points was observed, indicating a positive change in students’ knowledge and skills.

TABLE 1 ENTRY AND EXIT TEST DATA

Serial number student	O1 – Entry Test	O2 – Exit Test
S1	20	30
S2	25	30
S3	15	25
S4	15	25
S5	25	30
S6	20	30
S7	10	20
S8	15	20
S9	15	20
S10	10	20
S11	20	30
S12	20	25
S13	10	20
S14	15	25
S15	15	25
Σ	250	375

TABLE 2 ENTRY AND EXIT TEST RESULTS

	O1 – Entry Test	O2 – Exit Test
$\bar{X}$	16,66	25
$D = \bar{X}O1 - \bar{X}O2$	8,34	

The percentage increase (1) is approximately 50 % compared to the baseline calculated using the following formula

$$\frac{O_2 - O_1}{O_1} \times 100 = \frac{8,34}{16,66} = 50,06 \% \quad (1)$$

We analyzed the data from the survey through descriptive and comparative statistics. The results of the initial survey on students’ motivation and digital competence show that 60% of respondents feel motivated to develop conversation skills (counseling), but only 40% believe that they could have a consultative conversation with a client. Regarding their interest in innovative training methods such as chatbots, simulations, interactive

presentation systems, and others, half of the respondents (53.3%) reported increased interest. Students' digital competence regarding the use of AI tools (AI assistants, chatbots) for learning, working, and other purposes is high (60%), which confirms their motivation and interest. At the same time, however, respondents do not feel confident to conduct a text dialogue with a chatbot on their own (40%). The majority of students (60%) note in the initial survey that they expect to improve their skills in conducting consultative conversation after conducting simulation training with a chatbot.

The results of the post-training survey register the students' feedback on the training conducted. One of the key questions in the survey finds out whether the chatbot simulation recreates a consultative situation that is as realistic as possible. According to 66.6% of students, this type of simulation is very useful for training purposes and creates a sense of real-life experiences. The majority of respondents (73.3%) also share that after the simulation they feel more motivated and confident in conducting a consultative conversation, as well as that it helps them to recognize and validate the emotions of the client - a chatbot - more clearly. Taking into account the nature of the work of the helping specialists, including social workers, the awareness of one's own strengths and weaknesses is extremely important for the implementation of quality and effective work. In this regard, 60% of students share that this type of training helps them identify what aspects of their verbal and non-verbal communication and reactions contributed to the success of counselling session and what hindered it. 86.6% of respondents are adamant that the use of interactive teaching methods such as chatbot simulations and the like will be beneficial for students throughout the educational process in various disciplines. Their expectations are to provide more opportunities for applying AI in their education so that they can build on their knowledge with practical skills that closely resemble the real work environment.

To verify the statistical significance of the differences between the input and output measurement, we applied a t-test for dependent samples. The resulting difference between the two measurements is statistically significant ($t(14) = -13.23, p < 0.001$).

In addition to statistical significance, we also calculated the effect of the Cohen's d intervention on dependent samples. The obtained value ($d=1.25$) shows an exceptionally strong effect of learning through chatbot simulation on student performance.

The formulated research hypothesis, according to which the application of a simulation method using artificial intelligence in the training of students leads to a statistically significant improvement in results and an increase in learning motivation, is confirmed on the basis of the analysis of the data from the pilot experimental study.

The findings suggest that AI-supported simulated scenario-based learning can provide pedagogical advantages compared to conventional learning methods

often applied in social work education. Traditional teaching methods in this field, especially in Bulgarian social work education, limit students' opportunities for active experimental participation. In contrast, interactive pedagogical situations supported by artificial intelligence allowed students to participate in simulated professional interactions through which to practice communication, decision-making, and problem-solving skills in a more interactive and practice-oriented environment. The observed improvement in pre- and post-test scores indicates that integrating simulations using artificial intelligence can contribute positively to increasing students' motivation and engagement in learning.

The study is subject to several limitations. The experimental intervention was carried out within a single-group pre/follow-up test design, without a parallel control group, which limits the direct comparison with conventional discussion approaches in social work training. In addition, we conducted the study in a university setting and included a relatively specific student population, which may affect the applicability of the results in other educational contexts. However, the study offers initial empirical evidence on the applicability of simulated AI-supported interaction scenarios in practice-oriented higher education.

The innovation of the proposed approach lies not only in the use of the AI technology itself, but also in the fact that we have integrated simulated scenarios for professional interaction, supported by artificial intelligence, aimed at experiential and practical learning. In this regard, the research contributes to the growing volume of research on pedagogical models enhanced with artificial intelligence in higher education.

The results of the experimental study are in line with recent research on the integration of AI in social work education. Modern studies have found that AI-supported learning environments are useful and recommended for social work educators [36], [37]. Furthermore, studies focused on ethical dilemmas and professional decision-making have considered the potential of ChatGPT as a supporting tool in social work training, through which to develop skills such as effective communication, reflection, without replacing the human element of the profession [38].

Contemporary research highlights the need for balanced and pedagogically controlled integration of AI. A recent study highlighted the potential risks associated with over-reliance on AI technologies, especially in terms of reducing human interaction in educational environments [39]. Therefore, through the results of this study, we support the understanding that educational technologies using AI should be perceived as complementary tools and not replace the pedagogical role of the educator.

The proposed approach can be interpreted within the broader historical evolution of educational technologies, where a gradual transition from traditional learning models to interactive and practice-oriented learning environments is demonstrated. In this context, we believe that AI-

supported simulation learning is perceived as a modern stage in the integration of smart and experimental technologies in higher education in social work.

IV. CONCLUSION

The topic of AI in student education as part of educational technology is important for two main reasons. The first is related to the quality and effectiveness of education. The second arises from the need to implement and utilize new teaching methods in accordance with global trends and the evolution of future professions. The results of the study show that the use of interactive AI-based teaching methods, such as a chatbot simulation in students' education, increases their motivation and leads to higher results. This means that a more in-depth study of the potential of AI for educational purposes is needed, which could serve as a basis for future research.

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