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ARTIFICIAL INTELLIGENCE IN EDUCATIONAL TECHNOLOGY

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Artificial Intelligence (AI) has become a significant factor that affects the process of using an educational technology. AI has largely affected the shape of the modern educational technology. AI-based learning has emerged as the trendsetting model of modern education. This model makes an emphasis on using various aspects of Artificial Intelligence. When used appropriately, AI-based learning provides an efficient approach to increasing the effectiveness of using the TPACK framework in the realm of educational process. The current paper covers the survey conducted with the purpose of determining the academic benefits which AI-based learning brings to the educational process. The current paper's findings demonstrate the effect that AI-based learning has on modernization and facilitation of the learning process.

Keywords: *edutech, online learning, E-Learning, AI, ICT, distant learning*

Introduction

The field of educational technology, also known as edutech, represents a learning approach emphasizing the wide and extensive level of integration between information technologies and educational process.The main goal of this field is replacement of the traditional paper-based teaching media with their digital-based alternatives. Educational technology has achieved a high level of popularity and adoption in the learning process of various subjects taught at secondary and higher education level. In the majority of cases, one of the most adopted ways to integrate educational technology with the learning process is the display of multimedia content with interactive educational content. [1] Also Internet access has always been the main requirement for the usage of ICT in the educational context. [2]

However, the recent trends in the progress and evolvement of modern ICT have caused a tremendous level of changes in the current state of educational technology. The emergence of the theory and practice of AI is expected to have a major influence impact on ICT landscape in general and educational technology in particular. [3][4]

The need for adopting the concepts and methods from AI to educational technology has been accentuated by the studies carried out by researchers and educators from different sectors of education. The published works demonstrate the positive outcomes that the integration of AI and educational technology can bring to the educational process. The existing research covers a multitude of educational advantages that are to be brought both for teachers and students. Thus, as indicated by the research [5][6], the integration of AI and educational technology can potentially yield academic benefits, encompassing enhancements in students' cognitive abilities and their attitudes toward learning. The findings from [7][8][9][10] also confirm the positive effect that AI can bring to educational technology.

The current study explores how the integration of AI and educational technology can positively affect such area of educational technology as Technological, Pedagogical and Content Knowledge (TPACK) framework. The main emphasis is made on analyzing how the students' attitude towards learning is affected by the adoption of methods from AI.

Theoretical Framework

The current study interprets the term "Artificial Intelligence" as software solutions simulating in an efficient way human-like intelligent reasoning and behavior which can bring educational value to learning process.

The Technological Pedagogical and Content Knowledge (TPACK) is defined as a framework within educational technology designed to deal with various challenges that educators and students meet in the process of adoption of ICT tools for the academic purposes. The framework is to provide educators with scientific-based means to overcome various obstacles met in the classroom based on usage of ICT. The TPACK framework serves its intended purpose by finding the most appropriate ways to combine such components as technology, pedagogy, and knowledge [6]. The TPACK framework is based on substantiated assumption the interconnection between technology, the knowledge and the content create conditions for pedagogical advances and is able to facilitate students' academic performance. According to [6] the TPACK framework stresses out three fundamental domains of knowledge. These domains include such components as technological knowledge, pedagogical knowledge, and content knowledge.

The domain of technological knowledge encompasses various ways in which teachers employ ICT tools in their work. It encompasses software and hardware solutions used in the learning process. The main prerequisite of this domain is skills in using various forms of educational technology to increase the effectiveness of the learning process in a classroom. Technological knowledge also requires an ability to keep aligned with the latest technological trends and developments.

The domain of content knowledge deals with the level of knowledge that instructors must possess, related to the academic discipline taught in a classroom. In additional to level of knowledge, this domain also encompasses such auxiliary concepts as learning methodologies and frameworks applied to distribute the knowledge to students. The interpretation of content knowledge differs from one educator to another depending on the specific academic interests and learning environments.

The domain of Pedagogical knowledge included the various ways by which a teacher presents the material and what he does to make this presentation accessible to students. It mostly encompasses methodologies and standard practices used in learning. It also deals with such variables of the learning process as the goals and objectives of learning, lesson planning and scheduling, classroom management etc.

In many instances, instructors opt for a blend of specific domains. The three most prevalent combinations include technological pedagogical knowledge, technological content knowledge, and pedagogical content knowledge.

Technological pedagogical knowledge emerges from the fusion of technical expertise and pedagogical understanding. It encompasses the various interactions established between ICT tools and pedagogical methodologies and concepts.

Pedagogical content knowledge arises from the amalgamation of pedagogical expertise and content knowledge.

It covers interactions and relationships existing between learning goals and pedagogical principles and methodologies.

The domain of technological content knowledge emerges as the result of combination of technological knowledge and content knowledge. It encompasses the relationships that are formed between learning goals and ICT tools used to achieve these goals.

Figure 1 provides a visual presentation of the structure of the TPACK framework.

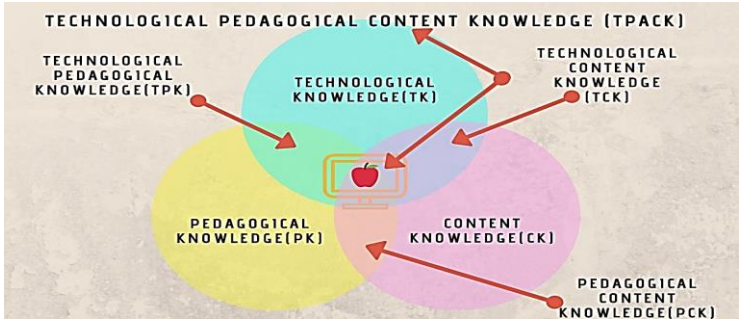

Figure 1 – The structure of the TPACK framework

Using one of these three combinations, it becomes possible for an instructor to use the TPACK framework as the model for increasing the academic outcomes with the means of effective integration of educational technology and the existing learning process. However, the main challenge in this process lies in selecting the most appropriate combination of the described knowledge domains. And to a larger extent, this process can be significantly improved by making use of AI combined with appropriate treatment various factor emerging during the academic acivities.

Methods

To verify the hypothesis stating the effectiveness of using AI methods in tandem with the TPACK framework an experiment was conducted. The experiment was carried out online and organized by conducting survey and questionnaire among 15 mathematics instructors who use the TPACK framework for training students participating in online Olympiads. Seven of the surveyed instructors specialized in Computer Science, five specialized in mathematics and three in computational physics. The choice of the respondents was made on a random basis to avoid various biases which may affect the evaluation of the survey's results.

The main purpose of the survey was to evaluate the percentage of the respondents which answered a particular question. If a respondent failed to answer a question in one way or another it was considered to be equal to 0 percent. The respondents were given two weeks to complete all the questions and send them back to interviewers.

The questionnaire was distributed to students through the means of email. It contained the following questions given in Table 1:

Table 1 – The items of the questionnaire

N	Content
1	*Do you use the methods provided by Artificial Intelligence in the process of choosing the most appropriate combination of TPACK's knowledge domains for organizing your own teaching process?*
2	*Does Artificial Intelligence provide an effective contribution to the improved application of TPACK framework's concepts in a classroom?*
3	*Do you recommend the application of AI methods to students whose classroom uses the concepts of the TPACK framework?*
4	*Has the usage Artificial Intelligence's concepts in teaching process changed the educational landscape significantly?*
5	*What specific Artificial Intelligence technology or solution do you use the most for educational purposes?*
6	*What are the main drawbacks of using the methods and concepts of Artificial Intelligence in the learning context?*

The first, second, third and fifth questions of the questionnaire attracted the responses from all 15 respondents. The fourth question was answered only by 12 respondents, while the last question received the answers from 13 respondents.

The results extracted from the survey were analyzed by the means of online statistical analysis resources. The verification of the obtained data was held by the means of Mann-Whitney U test whose formula is given on the Figure 2 below.

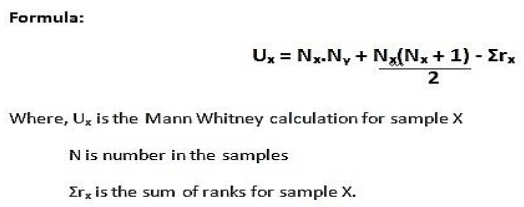

Figure 2 – The formula for Mann-Whitney Test

Results

Figure 3 below demonstrates the respondents' answers to the first question.

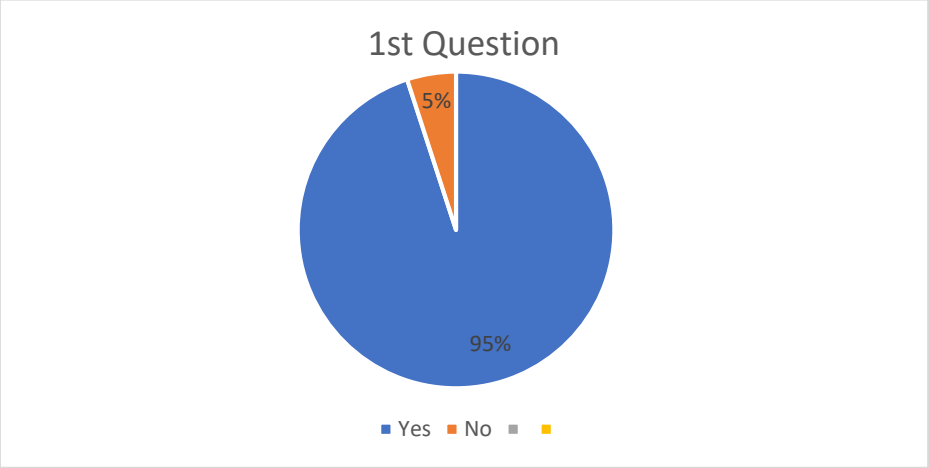

Figure 3 – The answers to the first question

Figure 3 demonstrates that in the majority of cases, the respondents used AI to choose a combination of TPACK's knowledge domains.

Figure 4 below demonstrates the respondents' answers to the second question.

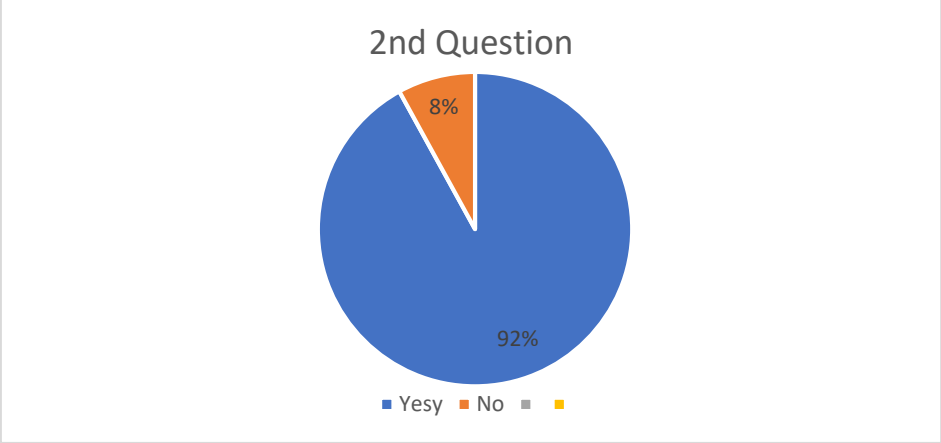

Figure 4 – The answers to the second question

Figure 4 shows that the larger part of the respondents consider AI to be an effective tool for facilitating the usage of TPACK in educational context.

Figure 5 below demonstrates the respondents' answers to the third question.

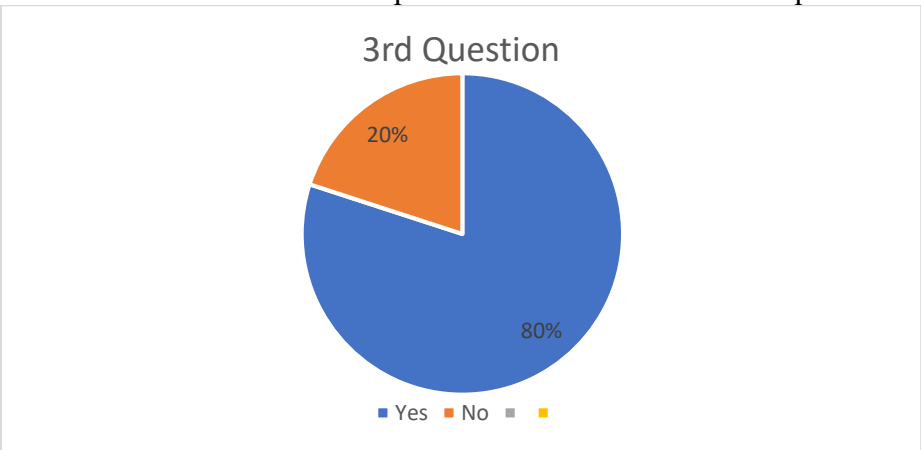

Figure 5 – The answers to the second question

From Figure 5 it is easy to see that the majority of the interviewed recommend the usage of AI to students.

Figure 6 below demonstrates the respondents' answers to the fourth question.

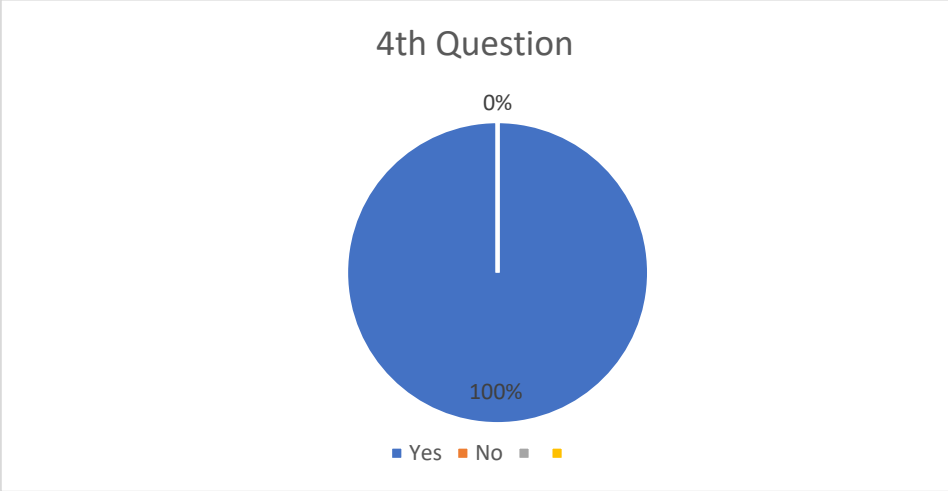

Figure 6 – The answers to the fourth question

Figure 6 demonstrates that all of the respondents consider the learning landscape to be affected considerably by AI.

Table 2 holds the results of the answers to the fifth question of the questionnaire

Table 2 – Results of the answers to the fifth question

Answer	Percentage
Chatbot	60%
Machine Learning	30%
Deep Learning	10%

As is seen from Table 2 the majority of respondents use chatbots as their main AI technology.

Answering the last item of the questionnaire, 100 percent of the respondents mentioned that the main drawback of using AI is that it has a tendency of reducing students' ability to independent thinking.

Discussion

The obtained results demonstrate that the application of AI methods has a major role in the development of ICT in the context of educational technology. The emergence of this concept has significantly changed the current landscape and trends in educational technology. The current survey allows to come to the following conclusion covered below.

Teachers actively use the methods provided by Artificial Intelligence in the process of choosing the most appropriate combination of TPACK's knowledge domains for organizing their own teaching process. This choice is not done randomly, but is based on evaluating the various factors and variables.

Artificial Intelligence does an effective contribution to the improved application of TPACK framework's concepts in a classroom. Moreover, this contribution does not depend on the particular academic discipline.

Teachers actively recommend the usage of AI methods in their learning process, particularly in the field of self-education.

The application of AI practices and concepts in teaching process significantly change the educational landscape and pedagogical approaches.

As the survey shows chatbots are the dominant AI technology used by educators and students.

The results of the current study prove the educational advantages that can be brought by the integration of AI and educational.

Conclusion

To increase its effectiveness, educational technology needs to adopt the concepts and methods provided by AI. The need for application of the concepts and methods from AI to educational technology has been accentuated by the studies carried out by researchers and educators from different sectors of education. The published research demonstrates the positive outcomes that the integration of AI and educational technology can bring to the educational process. The existing studies cover a multitude of educational advantages that are to be brought both for teachers and students. Thus, the integration of AI and educational technology can potentially bring many academic benefits, encompassing enhancements in students' cognitive abilities and their attitudes toward learning. The findings from various studies also confirm the positive effect that AI can bring to educational technology.

The current study demonstrates one of the possible ways by which the integration of AI and technology can have a positive impact on the TPACK framework. The main emphasis is made on analyzing how the students' attitude towards learning is affected by the adoption of methods from AI.

REFERENCES

1. Kuimova M. V., Kiyanitsyna A., Truntyagin A. E-learning as a means to improve the quality of higher education learning to undergraduate midwifery students from a practice-based perspective. //Nurse Education in Practice. -2016.- Vol.14(2).

2. Domingo Marta Gómez and Antoni Badia Garganté. Exploring the use of educational technology in primary education: Teachers' perception of mobile technology learning impacts and applications' use in the classroom. //Comput. Hum. Behav. - 2016.-Vol.56-P. 21-28.

3. Al-Takhyneh B. Attitudes towards using mobile applications in teaching mathematics in open learning systems. International Journal of E-Learning & //Distance Education. -2018.-Vol. 33(1). -P.1-16.

4. Seo, K., Tang, J., Roll, I. *et al.* The impact of artificial intelligence on learner–instructor interaction in online learning. *Int J Educ Technol High Educ* 18, 54 (2021). https://doi.org/10.1186/s41239-021-00292-9

5. Seo, K., Fels, S., Yoon, D., Roll, I., Dodson, S., & Fong, M. (2020b). Artificial intelligence for video-based learning at scale. In Proceedings of the Seventh ACM Conference on Learning@ Scale (pp. 215–217).

6. Touretzky, D., Gardner-McCune, C., Martin, F., & Seehorn, D. (2019). Envisioning AI for K-12: What should every child know about AI?. In: Proceedings of the AAAI conference on artificial intelligence (Vol. 33, No. 01, pp. 9795–9799).

7. Xu Y, Liu X, Cao X, et al. Artificial intelligence: A powerful paradigm for scientific research. Innovation (Camb). 2021;2(4):100179. Published 2021 Oct 28. doi:10.1016/j.xinn.2021.100179

8. Ahmad, S.F., Han, H., Alam, M.M. et al. Impact of artificial intelligence on human loss in decision making, laziness and safety in education. Humanit Soc Sci Commun 10, 311 (2023).https://doi.org/10.1057/s41599-023-01787-8

9. Hassani, H.; Silva, E.S.; Unger, S.; TajMazinani, M.; Mac Feely, S. Artificial Intelligence (AI) or Intelligence Augmentation (IA): What Is the Future? AI 2020, 1, 143-155. https://doi.org/10.3390/ai1020008

10. Seo, K., Tang, J., Roll, I. et al. The impact of artificial intelligence on learner–instructor interaction in online learning. Int J Educ Technol High Educ 18, 54 (2021). https://doi.org/10.1186/s41239-021-00292-9

ИСКУССТВЕННЫЙ ИНТЕЛЛЕКТ В ОБРАЗОВАТЕЛЬНЫХ ТЕХНОЛОГИЯХ

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Искусственный интеллект (ИИ) стал значимым фактором, влияющим на процесс использования образовательных технологий. ИИ в значительной степени повлиял на формирование современных образовательных технологий. Обучение на основе ИИ стало передовой моделью современного образования. Эта модель делает акцент на использовании различных аспектов искусственного интеллекта. При правильном использовании обучение на основе ИИ обеспечивает эффективный подход к повышению результативности использования системы TPACK в образовательном процессе. В данной статье рассматривается исследование, проведенное с целью определения академических преимуществ, которые обучение на основе ИИ привносит в образовательный процесс. Результаты исследования демонстрируют влияние обучения на основе ИИ на модернизацию и облегчение учебного процесса.

Ключевые слова: *edutech, онлайн-обучение, E-Learning, ИИ, ИКТ, дистанционное обучение*

БІЛІМ БЕРУ ТЕХНОЛОГИЯЛАРЫНДАҒЫ ЖАСАНДЫ ИНТЕЛЛЕКТ

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Жасанды интеллект (ЖИ) білім беру технологияларын пайдалану процесіне әсер ететін маңызды факторға айналды. ЖИ қазіргі заманғы білім беру технологияларын қалыптастыруға айтарлықтай ықпал етті. ЖИ негізінде оқыту қазіргі заманғы білім берудің озық үлгісіне айналды. Бұл модель жасанды интеллекттің түрлі аспектілерін пайдалануға баса назар аударады. ЖИ негізінде оқыту дұрыс пайдаланылған жағдайда білім беру процесінде TPACK жүйесін пайдаланудың нәтижелілігін арттыруға тиімді тәсілді қамтамасыз етеді. Бұл бапта ЖИ негізінде оқыту білім беру процесіне әкелетін академиялық артықшылықтарды анықтау мақсатында жүргізілген зерттеу қарастырылады. Зерттеу нәтижелері ЖИ негізінде оқытудың оқу процесін жаңғыртуға және жеңілдетуге әсерін көрсетеді.

Кілт сөздер: *edutech, онлайн оқыту, E-Learning, ЖИ, АКТ, қашықтықтан оқыту.*