

# APPLICATION OF ARTIFICIAL INTELLIGENCE IN PRE-UNIVERSITY EDUCATION – CASE STUDY SCHOOLS IN THE MUNICIPALITY OF KAMENICA – KOSOVO

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**Abstract:** *Pre-university education in general is facing various challenges, but in the schools of the Municipality of Kamenica the challenges are even greater in improving learning outcomes in teaching and learning, these challenges range from identifying individual student needs and optimizing learning resources.*

*This paper examines the role and impact of artificial intelligence (AI) in improving and facilitating learning circumstances in schools in the Municipality of Kamenica in Kosovo. The main goal is to analyze how AI solutions can improve the level of learning, support effective teaching and help in assessing and attracting students by increasing their level of concentration.*

*In this paper, we have taken an empirical approach using real data from several pre-university education schools in Kamenica, which include test scores, attendance statistics, and information on learning activities. With the help of machine learning techniques, models have been built that identify student profiles with different performance and recommend personalized learning strategies for each profile. An AI-based recommender system has also been developed that suggests teaching materials and relevant exercises using virtual laboratories according to the needs and individual progress of students.*

*The results show that the use of AI tools helps in identifying student weaknesses more quickly, in creating personalized lesson plans and in facilitating the work of teachers for continuous monitoring and evaluation. The analysis also shows the perception of teachers and parents across the Municipality of Kamenica towards the integration of AI in teaching practice, highlighting the challenges and opportunities for wider implementation in pre-university education in Kosovo.*

*This case study that we have conducted in the Municipality of Kamenica offers a practical and strategic contribution to municipal education policies towards the effective use of advanced technologies in the teaching process not only in the Municipality of Kamenica but also beyond.*

**Keywords:** Artificial intelligence, machine learning, pre-university education.

## 1. Introduction

As in other countries, technology has significantly transformed the education system, creating new opportunities for improving the teaching and learning process. In modern education, the use of technology is no longer considered just an auxiliary tool, but as an essential component for developing students' skills, developing critical thinking and increasing the quality of the education system.

The Municipality of Kamenica has a territory of 423 km<sup>2</sup>. It consists of the town of Kamenica as an urban center and 56 villages, the Municipality of Kamenica also has 27,823 inhabitants, has 3 upper secondary schools in the Albanian language, 2 upper secondary schools in the Serbian language, 13 primary and lower secondary schools in the Albanian language and 3 primary and lower secondary schools in the Serbian language, where in total there are 5 upper secondary schools and 16 primary and lower secondary schools.

One of the most important aspects of using technology in education is facilitating access to information, facilitating the work of teachers and activities for students. Through the Internet and digital platforms, students and teachers have access to a large number of educational resources, such as electronic books, educational videos, scientific databases and other didactic materials. This helps to expand knowledge and develop independent learning. Technology also contributes to increasing interactivity in the learning process. The use of interactive whiteboards that the Municipality of Kamenica has invested heavily in, online platforms, educational applications and multimedia tools makes learning more attractive and understandable for students. In this way, students are more engaged in the learning process and develop critical and creative skills.

The integration of technology in education improves the quality of the learning process, increases student motivation and prepares

them for the challenges of contemporary society, for this reason the Directorate of Education in Kamenica prioritizes the integration of technology in education, especially in lower secondary schools and primary schools. Therefore, it is very necessary for educational institutions to continuously invest in technological infrastructure and in the training of teachers for the effective use of technology in teaching.

## 2. Benefits of using AI in education

Kamenica, although a small city, the use of artificial intelligence in education has brought significant changes in the way the teaching and learning process takes place. AI offers new tools and methods that help increase the efficiency, innovation and quality of education.

One of the main benefits of artificial intelligence is the ability to provide coherent, innovative and current learning. AI-based systems can analyze student performance and adapt learning materials according to their individual level, pace and needs. This helps each student learn in the most effective way for them, and this helps create higher security among students also in relation to the assessment process which is defined in AI 06/2022.

AI can help teachers prepare teaching materials, design lesson plans and create exercises or tests. The use of AI helps reduce the administrative burden of teachers and gives them more time to focus on pedagogical aspects and direct work with students. The use of intelligent applications, digital platforms, virtual laboratories, interactive platforms and digital systems makes the learning process more interesting, interactive and attractive for students.

Through simulations, educational games and multimedia content, students are more actively involved in learning and this

increases student satisfaction and also allows parents to have easier access to their children.

The use of artificial intelligence in education contributes to improving the quality of learning, as quality is one of the main challenges in the entire educational process, increasing the efficiency of the learning process and developing the digital skills of students, making education more suitable for the demands of the parent community.

The municipality of Kamenica has a significant number of students who may have problems in their studies, in addition to the general difficulties that a municipality may have in education, Kamenica has also faced the closure of several schools for a while and a significant number of students have not attended school for several years, therefore AI can provide special tools for students with learning difficulties, such as voice recognition programs, automatic translation or applications that help with reading and writing.

The use of AI in the educational process is one of the advantages that the Municipality and the Directorate of Education can use to increase the level of satisfaction among parents, facilitate the work of teachers and increase the attractiveness among students.

Therefore, teaching AI in pre-university education is currently feasible, but the specific topics that should be taught at this age and to what extent these topics should be addressed are an open issue that needs to be discussed.

### 3. Challenges and risks of using AI in education

The use of AI in education is accompanied by challenges and eventual risks throughout the process, each municipality but especially the Municipality of Kamenica has challenges in implementing the use of AI in the educational process in primary schools, lower secondary schools and upper secondary schools.

If we start listing the challenges and risks in the use of AI in education, we should start from issues of privacy and data security, dependence on technology and the use of technology in an inappropriate way, plagiarism and credibility in teaching, lack of training for teachers, unequal access to technology, reliability and accuracy of information, etc.

#### 3.1. Data privacy and security

The use of platforms and applications based on artificial intelligence requires the collection and processing of a large amount of data on students and teachers. If this data is not managed securely, there is a risk of privacy violations and misuse of personal information, therefore the use of platforms in the educational process also requires relevant legislation to prevent possible privacy violations.

The Directorate of Education has contracted a company through a public tender to create a unique platform for managing the education system within the municipality and access to this platform can be done through the link: <https://www.kamenica-edu.net/>, but the issue of data privacy, their security was and remains one of the main challenges for management with this platform.

#### 3.2. Technology addiction

Excessive use of technology by students, lack of control over the use of technology can create dependence on digital systems and reduce the active role of the teacher in the teaching process. The educational process should remain a balanced process where technology serves as an auxiliary tool and not as a complete substitute for the teacher, where the use of technology enables more effective learning and not degradation of the process.

The role of the teacher is key in preventing the creation of dependence on the use of technology, digital platforms or even virtual laboratories, the school should enable capacity building at the school level to increase control in preventing the creation of dependence on technology among students.

#### 3.3. Plagiarism

Artificial intelligence tools, instruments and applications can be used by students to generate assignments, essays or projects without necessarily reflecting their real knowledge. This can negatively affect the development of critical thinking skills and the assessment of authorship.

Restricting the use of these AI-powered tools increases the level of assessment among students, puts into practice the legislation in force on the reliability of assessment and reduces the impact of AI on the authorship of papers, essays or projects by students.

#### 3.4. Lack of training for teachers

Many teachers may not have the necessary knowledge and skills to effectively use artificial intelligence in the learning process, which makes teaching effectiveness difficult. Without proper training and professional support, the integration of AI in education may be limited, it may be an inefficient project and in order to have expectations of good results, the education directorate, together with the school management, must plan and organize school-based training, training that will help teachers increase their digital competence.

The Education Directorate in Kamenica has made and is making continuous efforts to increase the budget that will be allocated for the training of educational staff and this budget will be the weight of success in the future for a complete success.

#### 3.5. Without equal access to technology

Not all schools in the Municipality of Kamenica and students have equal access to technological equipment and the internet. This can create a digital divide between different schools or regions, affecting equal opportunities for quality education.

Kamenica is a municipality bordering Serbia and has a large territory, a territory that does not allow equal access to technology, the internet and applications that are ready to provide resources for use in AI.

#### 3.6 Reliability and accuracy of information

Artificial intelligence systems are not always accurate and can generate inaccurate or incomplete information. If students rely entirely on these systems without critical verification, this can affect the quality of learning.

Early childhood education, education on the use of technology and identification of safe sources of information makes the system more efficient and reliable by enabling students to identify fake news, identify safe sources and this helps us to have a stable and safe system.

### 4. Research methodology

During this work, we have taken into consideration the analysis of data obtained from student questionnaires, teacher questionnaires and interviews with school principals.

The sample was purposive, where we treated 2 upper secondary schools and 3 lower secondary schools, a total of 5 schools, where 37 teachers, 72 students and 5 school principals participated in this research, where we conducted a statistical and comparative analysis.

### 5. The current state of technology use in schools

Schools in the Municipality of Kamenica are generally supplied with technology equipment and this has led to better conditions for students and teachers. As a Municipality, it is a special specificity that the number of students in schools is not that large and the Directorate of Education has enabled each school at the level of lower secondary schools in each classroom to have a smart TV, laptop, computer, and the classrooms to be adapted in such a way that lighting is not an obstacle to the development of the learning process.

While the situation is different in upper secondary schools because there is a need for investments in creating favorable conditions for the learning process, supplying schools with technology equipment, increasing internet capacity throughout the school space, and training teachers in the use of technology and the use of AI platforms.

There has been and continues to be a problem in implementation with schools in the suburbs where there are problems with internet access, the need for teacher training, and also the need for students to have extra classes, supplementary lessons, or elective lessons for the subject of computer science.

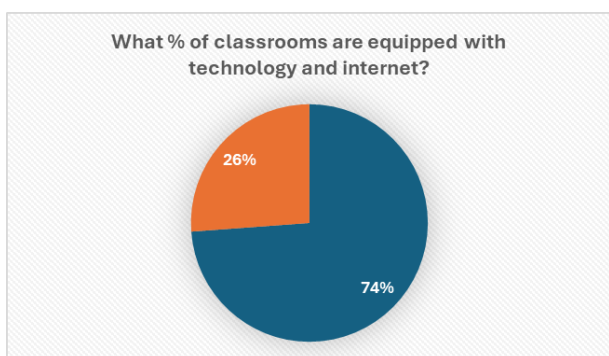


Figure 1. Infrastructure in schools regarding information technology

### 6. Use of AI by students and teachers of the Municipality of Kamenica

The use of AI by students and teachers in the educational process is an indispensable need to enable increased quality and increased attractiveness to students. In addition to daily use in lessons, teachers have the opportunity to prepare their materials and then have them ready for their explanations to students.

During the implementation of the questionnaire with students, the question: Have you ever used artificial intelligence tools to assist in learning? In this case, 74% of students responded that they have AI tools to assist the learning process, while only 26% responded with No.

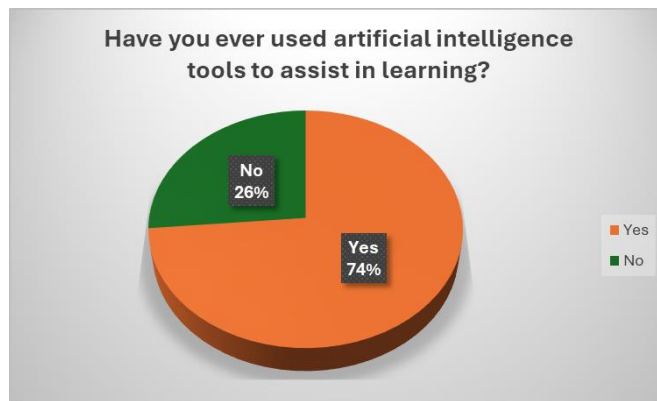


Figure 2. Have you ever used artificial intelligence tools to assist in learning?

Of the 74% of respondents who answered Yes, 64% of them said that they use AI more to understand a certain topic, 21% of them to do homework or write essays, and 15% of them to search for information.

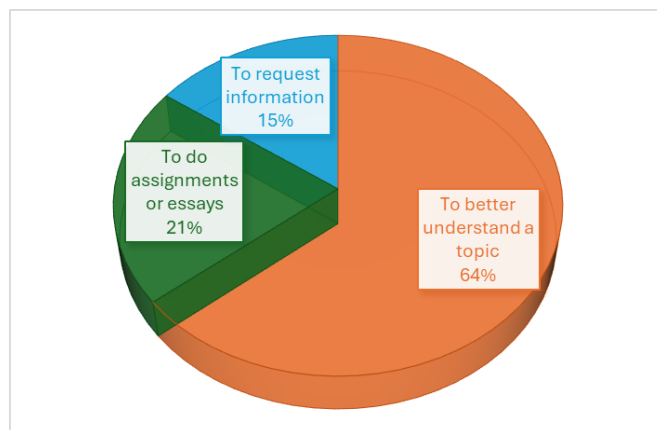


Figure 3. If so, what do you use them for most often?

During this study, we also addressed the impact of AI on lessons from both the student and teacher perspectives, asking: Do you think AI helps you understand lessons better?

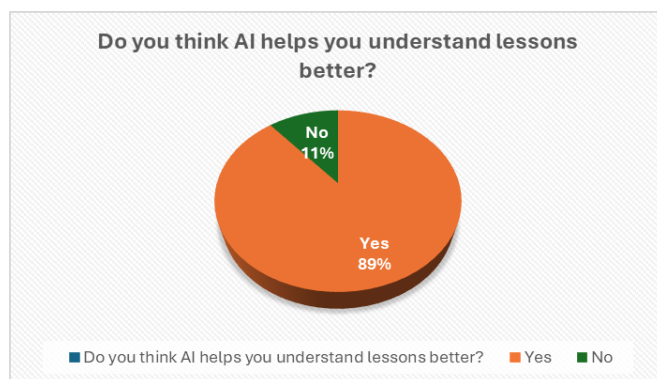


Figure 4. Do you think AI helps you understand lessons better?

From the diagram we can see that 89% of respondents answered Yes while only 11% of respondents answered No.

The treatment of this topic is very sensitive in terms of the possible impact of AI on the educational process and this situation is also presented to us in the following question: Do you think that the use of AI makes learning more interesting?

From here it can be seen that 62% of respondents answered that they think that the use of AI makes lessons more interesting, 31% of them think that the use of AI makes lessons interesting sometimes and only 7% think that the use of AI in lessons does not affect them to be more interesting and attractive.

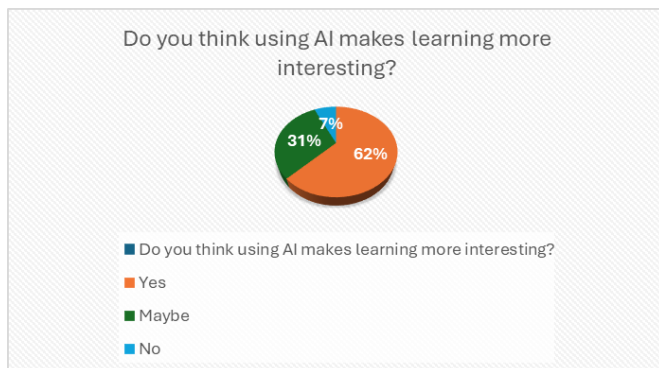


Figure 5. Do you think using AI makes learning more interesting?

The education system and the institutions that are responsible for improving the situation in education will increasingly focus on ensuring that the system in general is sustainable to ensure quality, to have security for students but also to be easily accessible for parents, to make the daily work of teachers easier by enabling them to make the learning and teaching process more attractive through the use of technology.

The next question that was asked to the students was: Do you think that the use of AI can cause students not to work enough on their own?

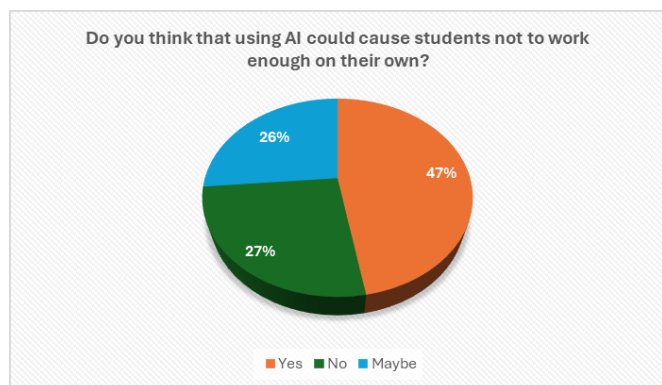


Figure 6. Do you think that using AI could cause students not to work enough on their own?

From the responses we have processed, we see that 47% of respondents think that the use of AI can cause students to not work independently and sufficiently, 26% think that this phenomenon sometimes occurs, while 27% of respondents think that AI does not affect students not working sufficiently.

One of the main challenges for the use of AI in the educational process is the preparation of educational staff, their readiness to use various platforms in the educational process.

We have conducted a questionnaire with 37 teachers from 5 schools in total that we conducted the research at the level of the Municipality of Kamenica.

In the question we conducted for teachers: Have you received any training on the use of digital technologies or AI in teaching?

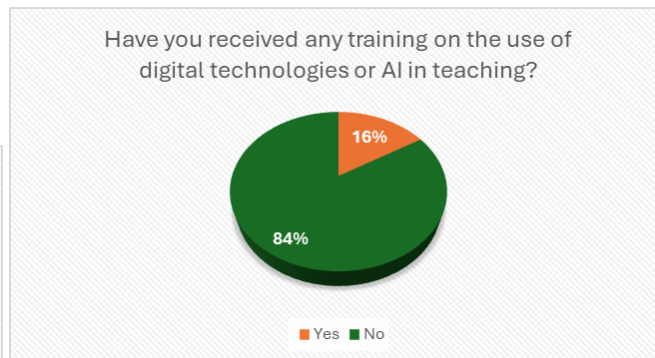


Figure 7. Have you received any training on the use of digital technologies or AI in teaching?

One of the main challenges to implementing and increasing the use of AI in the educational process is teacher training, the advanced age of teachers, and the preparation of legislation that would also include the use of AI in the teaching process.

In the next question, which deals with the use of AI tools in the teaching process, the question was: Do you use artificial intelligence tools in the preparation of teaching materials?

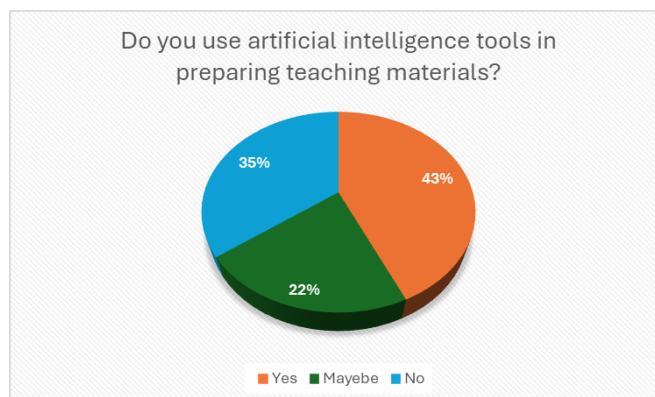
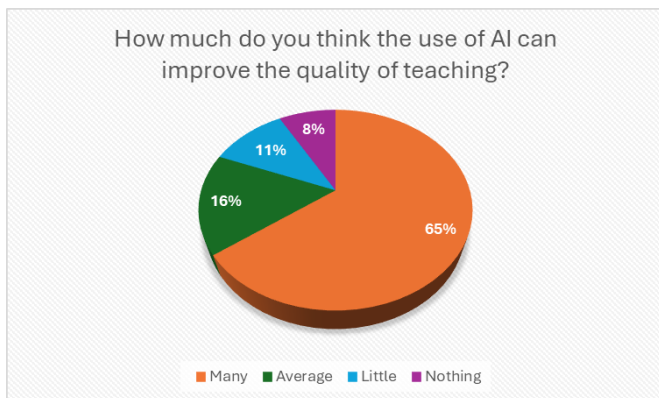


Figure 8. Do you use artificial intelligence tools in preparing teaching materials?

Of the teachers surveyed, we see that 43% of them use artificial intelligence tools to prepare teaching materials, 22% of them do not use these tools always, while 35% of teachers do not use artificial intelligence tools at all to prepare teaching materials.

A significant number of respondents, about 35% of whom stated that they do not use AI tools to prepare teaching materials, may result from the fact that teaching staff still use tools that are classical and are not yet ready for various reasons to use AI in the teaching process.

The entire research is about the state of the education system, the use of AI tools, and what impact it has on improving the state of the education system. The next question posed to teachers is: How much do you think the use of AI can improve the quality of teaching?



**Figure 9. How much do you think the use of AI can improve the quality of teaching?**

From the diagram we see the results that we have shown where 65% of teachers think that the use of AI tools can improve the quality in education, 16% of them think that the quality situation will improve on average if we use AI elements, 11% of teachers think that AI tools have little impact on improving the situation and quality in education while 8% of the surveyed teachers think that AI tools do not affect the improvement of the situation in education at all.

If the last question and result are carefully analyzed and compared with the previous question, we see that teachers are optimistic that the use of AI will positively affect the educational process, but we still have an unstable situation on the way and AI tools that teachers are using.

## 7. Challenges in implementing AI in schools

The integration of artificial intelligence tools into the education system in schools in the Municipality of Kamenica is an important step towards the modernization of the teaching and learning process. However, the implementation of these technologies in schools is accompanied by several challenges that need to be carefully addressed by educational institutions and specifically by the Directorate of Education.

The main challenges that may arise during the implementation of AI tools in schools in the Municipality of Kamenica are: lack of IT infrastructure, lack of training for teachers, resistance to change, lack of clear policies and guidelines, and the issue of creating a legal framework or regulations at the municipal or school level.

During the interview with the principals of the respective schools, they stated that one of the main challenges during the efforts to implement the use of AI tools in schools and their use is also the resistance from the staff, the resistance to switching from one system to another.

## Conclusions

During this study, we have managed to see the importance of using AI in the teaching process in both upper secondary and lower secondary schools, the impact of the use of AI by students during the teaching process, the challenges and advantages that we may have during this process.

If we carefully analyze the results of the responses from students and teachers, we see that we have very promising results and that they let us know that the use of AI in the educational process is the right alternative to have better results and to have a higher interest among students.

According to school principals, another challenge is the lack of supporting infrastructure and especially the lack of school inclusion in the internet or increasing internet capacity and inclusion of the entire school space.

One of the main concerns that should be resolved at the national level is for the Ministry of Education in Kosovo to draft Administrative Instructions that would enable this area to be regulated through legislation and for eventual actions to be based on the law, as this also avoids contestation by various actors who may be specific teachers, parents or other important factors.

Although artificial intelligence offers great opportunities for improving the quality of education, its implementation in schools, especially in a small municipality such as Kamenica, requires a budget to invest in infrastructure, professional development for teachers, and the creation of clear policies for the safe and ethical use of technology.

Only through a well-planned approach can the Directorate of Education successfully integrate artificial intelligence into the education system at both the upper secondary and lower secondary school levels.

## 8. Discussions and recommendations

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If we carefully analyze the results of the responses from students and teachers, we see that we have very promising results and that they let us know that the use of AI in the educational process is the right alternative to have better results and to have a higher interest among students.

Recommendations for possible improvements during the process will include investing in infrastructure, increasing the level of awareness campaigns for students, increasing the budget for training to increase support for professional development for teachers, investing in human resources in the field of IT in schools that will help the process both from a hardware and software perspective.

Increasing the capacity to have the legal infrastructure at the appropriate level to be a legal support for all activity in schools related to the implementation and use of AI in educational institutions at the level of upper secondary schools and lower secondary schools.

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