International Journal of Advanced and Applied Sciences, 12(6) 2025, Pages: 250-257

Contents lists available at Science-Gate

International Journal of Advanced and Applied Sciences

Journal homepage: http://www.science-gate.com/IJAAS.html

From theory to practice: The role of technology in enhancing student engagement and performance in mathematics education in Albania

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ARTICLE INFO

Article history:
Received 1 February 2025
Received in revised form
24 May 2025
Accepted 5 June 2025

Keywords:
Educational technology
Student engagement
Mathematics education
Mobile applications
Academic performance

ABSTRACT

This study explores the impact of mobile applications and computer programs on student engagement, motivation, and academic performance in university-level mathematics courses in Albania. As technology becomes more integrated into education, it offers new ways to support subjects that require abstract thinking and problem-solving, such as mathematics. Despite recent progress in adopting educational technology in Albania, challenges remain, including unequal access, limited infrastructure, and insufficient teacher training. Using data collected from 300 university students, this research applies simple regression analysis to examine the relationship between the use of digital tools and student engagement during mathematics lessons. The results show a significant positive correlation between the use of mobile and computer-based applications, both for theoretical learning and practical exercises, and increased student engagement. These findings highlight the potential of educational technology to enhance learning outcomes, while also pointing to the need for improved access, infrastructure, and teacher support. The study offers practical insights for educators and policymakers aiming to strengthen the role of digital tools in Albanian higher education.

1. Introduction

The advancement of technology has transformed all aspects of our lives, and education is no exception to this trend. Very often, when we think of the use of technology in teaching, the concept of learning with advanced devices such as computers and tablets, and the use of educational applications and software comes to mind. Technology has become a powerful and increasingly important tool in the field of education, offering opportunities to improve the learning experience and increase student engagement and motivation. This is especially evident in the fields of natural disciplines, such as mathematics, where abstract and complex concepts require external support to be understood and applied in ways that are understandable to students (Ní Shé et al., 2023).

In Albania, the use of technology in teaching has gained momentum in recent years, but there is still a long way to go to fulfill the full potential of this integration. While some schools and universities have implemented modern technologies, a large part of educational institutions still face major challenges in this regard, such as inequality in access to technology, lack of adequate infrastructure, and the need for training teachers in the use of these tools. However, recent initiatives and projects aimed at integrating technology into teaching processes are creating opportunities for advancing education in Albania and improving student performance (Ibrahimi et al., 2024).

In this context, the use of mobile applications and educational software to teach mathematics has received special attention. Mathematics, due to its logical and often abstract nature, can seem difficult for many students. Technology has enabled the creation of interactive tools that allow students to engage with learning material in a more dynamic and visual way. Applications for measurements, simulations, and programs for solving practical problems offer an opportunity to illustrate and practice mathematical concepts in ways that are more understandable and attractive (Zhang et al., 2025).

This study aims to examine the impact of the use of technology, especially mobile applications and computer programs, on mathematics learning,

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focusing on the effects that this can have on the activation and motivation of students, as well as on the improvement of their academic performance. To achieve this goal, data from 300 students from different universities in Albania will be analyzed, using simple regression statistical methods to test hypotheses and assess the relationship between the use of technology and academic performance. Through this study, a clear picture can be created of the effectiveness of the use of technology in improving mathematics learning, and to enable recommendations for the further use of technology in education.

Through this paper, it is intended to analyze not only the positive impact that technology can have on student performance but also the challenges and opportunities that occur during this process. Can a full and successful integration of technology in teaching be achieved, and what needs to be done to optimize its use in the Albanian context? These are some of the questions that this study will attempt to answer. These are some of the questions that this study will attempt to answer. This paper is part of the project "Advantages and Challenges of Integrating Digital Technology for Teaching Mathematics in the Pre-University and University Cycles," which is being developed by the research group of the Faculty of Economics, with the support of NASRI (National Agency for Scientific Research, Technology and Innovation).

2. Literature review

The integration of digital technology into teaching and learning plays a major role in effective teaching. In today's digital age, digital capabilities have facilitated teaching and made learning mathematics more interesting. Many researchers have analyzed the impact of using technology on the effectiveness of teaching in both mathematics and other subjects. Traditional teaching and learning of mathematics has become less interesting due to uninteresting learning content, which creates low levels of trust between students and teachers (Norton, 2024). According to Thomas (2017), digital game-based learning was a superior motivator of mental effort and time on task because, instead of students spending time with a game within a learning environment, students spent time learning within a gaming environment. Previously gamified learning and its impact on student learning outcomes analyzed. The findings suggest that game-based learning increases engagement as well as cognitive and problem-solving skills. This confirms that game-based learning is an effective teaching technique to use in today's classrooms.

To maximize learning, applications should focus on combining elements of autonomous learning, motor skills, task structure, engagement, skill demand, and personalization (Huntington et al., 2023). Eyyam and Yaratan (2014) investigated the impact of technology-enhanced mathematics instruction in secondary schools and found that students using technological tools not only achieved significantly higher scores on post-tests but also developed more positive attitudes toward the subject compared with those taught using traditional methods.

Huntington et al. (2023) in their study regarding the use of interactive whiteboards and mathematical software in high schools noted that the technology helps visualize abstract concepts, such as functions and equations, making them more understandable to students. Li et al. (2024) showed that: First, digital educational games positively influence students' motivation to learn; Second, learning engagement serves as a mediator between digital educational games and students' motivation to learn; Third, the digital environment moderates the relationship between digital educational games and students' learning engagement. Notably, the positive impact of digital educational games on students' engagement in learning is reinforced in a more inclusive digital environment. This study contributes to behaviorist theory and social cognition theory by clarifying how digital educational games influence students' motivation to learn through their engagement and by emphasizing the moderating role of the digital environment. Practically, these findings underscore the importance of digital educational games and digital environments in schools to increase students' motivation to learn.

Other authors have also analyzed the barriers encountered in the use of technology. The evolution of digital tools in education has created a disparity between the tools teachers use and those students have, leading to an unequal relationship. This disparity has hindered the transition from traditional teaching to student-centered learning, a crucial aspect of new approaches in cognitive psychology (Maziane et al., 2023). Joseph (2012) found that technology can improve interactions between teachers and students, but he emphasizes that technology cannot replace the human and social factors essential to teaching and learning.

Many authors, based on studies in developed countries, also look to developing countries, orienting them to strategies that can help fill the gap. Developing countries must spend heavily on technology and infrastructure if their educational institutions are to create world-class universities and increase the quality of education (Rodriguez-Segura, 2020). Developed countries have more resources, knowledge, skills, and experience than developing countries. However, developed countries suffer from many of the same challenges and concerns as developing countries, albeit to different degrees. They suffer from the same concerns of teacher retention and motivation, the lack of appropriate educational software and technical support, and the same challenges of providing adequate teacher training, addressing infrastructural deficiencies, and implementing learner-centered instruction and appropriate assessment procedures in schools (Jhurree, 2005). A study by Borko et al. (2010) found that sustained teacher training, supported by mentoring and ongoing collaboration, significantly increases teacher effectiveness and addresses infrastructural challenges. As highlighted in the study of Jhurree (2005), developing countries should learn from the strategies used by developed countries regarding the priorities they should set regarding the inclusion of technology in teaching, based on their needs, specificities, and capabilities. These countries need to spend heavily on technology and infrastructure if their educational institutions want to create world-class universities and increase the quality of education. Future research could explore how incorporating technology, like digital games and educational software, in developing countries can be aligned with local educational needs and resources to promote fair and lasting results. Recently, AI elements such as Machine learning (ML) are also being incorporated into teaching and curriculum development.

The inclusion of ML in teaching and curriculum development is an important step towards modernizing and improving education (Ejjami, 2024). This process can have major benefits, including personalizing learning, increasing the efficiency of the learning process, and preparing students for the challenges of the 21st century.

Integrating ML into curricula can be done at several levels to ensure a comprehensive and effective approach. This may include: Using ML to create personalized learning materials (Katiyar et al., 2024), improving curricula (Ball et al., 2019), creating a data-driven learning environment, and creating inclusive and effective educational environments (Wiliam, 2010).

3. Where is Albania located?

Technology in teaching has begun to spread in Albania in recent years, but it is still in the development phase and has a variable presence in schools and universities. Its spread and recognition are dependent on several factors, including financial resources, teacher training, technological infrastructure in schools, expert technical staff, administrative support, etc. In the studies by Keta and Sinaj (2024) and Keta et al. (2024), conducted with academic staff at the University of Tirana during the COVID-19 pandemic, it was highlighted that faculty members showed varying levels of technology use, which was influenced by their individual orientations and responsibilities. Faculties that offer computer science study branches had the highest level of technology use. The study analyzed the preferences of high school graduates in Albania and it is seen that high school graduates prefer branches that are related to technology (Sinaj et al., 2024a), while the study of Sinaj et al. (2024b) conducted with university students, it was emphasized that they demand that study programs be closer to the market and be supported with practical cases to make them even more capable. The inclusion of technology in teaching is a requirement of the time, which requires the cooperation of many actors and, of course, also needs great support from politics. Institutions in the country have also been engaged in various ways with the aim of including technology in teaching throughout the country.

In the Education Strategy 2021-2026, specific objective C7 is directly related to the Advancement of ICT infrastructure and digital services for public HEIs. The objectives are: Reforming the science curriculum in pre-university education by including STEM in education, raising awareness at all levels of pre-university education, to strengthen the role of young people in research and innovation, and developing digital competence.

For pre-university education, ASCAP, in collaboration with the UNICEF Office in Albania, produced a training manual to help school teachers in pre-university education. This material not only emphasizes the need to increase digital competencies but also provides tools that can be used by teachers to increase student interest and create an inclusive process. The manual discusses a number of online platforms that teachers can include during teaching.

For the 2022-2023 school year, the piloting of the ICT subject has begun from the first grade in 100 pilot schools, in which Smart Laboratories have been built. This project aims to improve teaching and learning through technology and has included the construction of smart laboratories in these schools, which are equipped with advanced technology to support digital learning.

In this context, the ICT curriculum for the first grade has been approved, and the basic education curriculum has been revised to include the new subject "ICT" as an elective subject for grades I-III. In the long term, the program aims to transform the ICT teaching system in pre-university curricula from grades I-XII, through updated curricula, teacher training, and equipping school facilities with the necessary infrastructure to carry out quality teaching of this subject. In the 2022-2023 school year, in collaboration with AADF, the piloting of the project "Artificial Intelligence for Youth" has begun in Albania.

In 2023, another project involving 300 schools was implemented. This is a project supported by the Ministry of Education and the Agency for Educational Services, which aims to integrate technology into Albanian education. This project, called "Equipping 300 Schools with Smart Laboratories," aims to improve the technological infrastructure in schools and integrate technology into the learning process. It aims to provide students and teachers with access to digital tools and platforms, enabling more effective teaching and better preparation for the challenges of technology.

This idea was further developed with the project "For improving equal access to high-standard public services through operation GOVTECH" (WBG, 2023). This project is a step to support the development of digital education and provide equal opportunities for all students, regardless of their geographical or economic position. Through this project, various schools in Albania have been equipped with smart laboratories, and the University of Tirana has been engaged in the realization and implementation of this operation, providing training and support for teachers and school principals (WBG, 2023). The initiative is expected to continue in 2025-2026 by installing over 600 new laboratories in 9 years and in high schools in the country.

An initiative to promote the use of technology in teaching is projects funded by NASRI for academic staff across the country in the priority area of "Information Systems and Technologies." Many projects announced by NASRI aim to use technology to improve teaching, as well as training for teachers, developing digital didactic materials, and creating online platforms for education. Most of these projects are focused on integrating ICT in schools and universities to increase the quality of teaching and to enable faster and more interactive learning.

On the other hand, the use of technology is closely related to technological tools and the use of the Internet. Fig. 1 shows the trend in the percentage of Internet use in Albania and the Europe and Central Asia region.

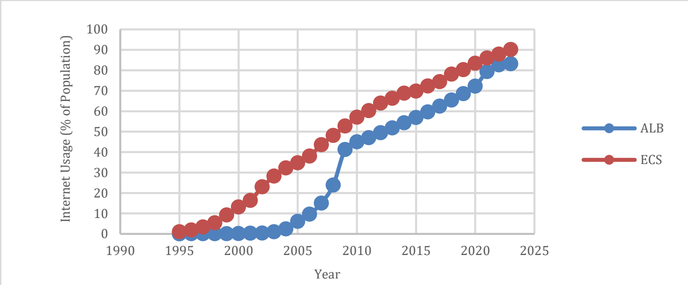

Fig. 1: Trends in internet usage (% of population) in Albania compared to Europe and Central Asia (1990–2025)

In Albania, by 2006, internet usage was less than 10% of the population. Its usage reached over 60% only after 2016 and has continued to grow, reaching 83% in 2023. Throughout the study period, this rate remains lower than the rate in Europe and Central Asia, which in 2023 is 90.1%. During the COVID-19 pandemic, the need for online communication caused an increase in demand for high-quality internet service (UNA, 2022).

After 2001, Albania followed the trend of other countries, reaching maximum values in 2015 and 2017. It then suffered a sharp decline in the following year and remained at these levels for years. In Fig. 2, the decline in mobile phone subscriptions (per 100 people) in Albania after 2017 can be linked to several factors, such as the spread of the internet and the use of other communication applications. These applications offer free or very low-cost communication options using the internet, and this has reduced the need for traditional mobile phone subscriptions. According to the mobile connectivity index, Albania scored 68.4 out of 100 points on average for mobile internet adoption in 2023. Consumer readiness, or the percentage of citizens with the necessary skills to browse the internet, received the highest score among the main performance categories with 87 out of 100 points. While ICT infrastructure is well-developed in urban centers, rural connectivity remains a challenge. In some regions, especially rural ones, costs can be high and penetration low. The lack of rural connectivity is "one of the major gaps" and hinders growth in the country (UNA, 2022).

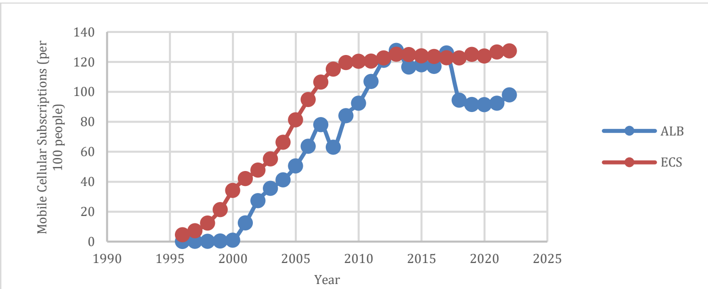

Fig. 2: Mobile cellular subscriptions per 100 people in Albania and Europe and Central Asia (1990–2025)

4. Empirical analysis

In this section, various factors that promote the use of technology in teaching mathematics and the impact of these factors on increasing student engagement during mathematics lessons will be analyzed. This increase in engagement has resulted in increased interest in this subject and improved student self-confidence. For this analysis, opinions were obtained from 300 students from various universities in the country, who have completed at least one academic year of mathematics courses, whether theoretical or applied. The data were collected using an anonymous questionnaire, which was distributed online to student networks. The data were analyzed for study purposes only and were treated with complete confidentiality. For the purposes of this paper, some of the responses received were analyzed, which helps in analyzing the following research hypotheses:

H1: More frequent use of technology during mathematics lessons is positively associated with increased student engagement during lessons.
H2: Encouraging the use of mobile applications by mathematics professors to better understand theoretical concepts is positively associated with increased student engagement during lessons.
H3: Encouraging the use of mobile applications by mathematics professors to understand practical situations and solve problems is positively associated with increased student engagement during lessons.
H4: Encouraging the use of computer programs by mathematics professors to better understand theoretical concepts is positively associated with increased student engagement during lessons.
H5: Encouraging the use of computer programs by mathematics professors to better understand practical situations and solve problems is positively associated with increased student engagement during lessons.

To test the research hypotheses, simple regression models will be evaluated, where the dependent variable is student engagement during mathematics lessons, while the independent variables represent each factor related to the respective hypotheses. Ordinary least squares (OLS) will be used to evaluate the models, and all processing was performed using the R Studio program. The general form of the estimated models is:

$$activation\ in\ math_i = \beta_0 + \beta_1 X_i + u_i,\ \ i = 1,2,\dots,300$$

where, β_0 is intercept. β_1 *is* coefficient of the model. X_i is independent variable. u_i are residuals.

After evaluating the regression, we will analyze whether the coefficients are positive and significant, which means that the independent variable has an impact on increasing student engagement during mathematics lessons. To test the research hypotheses, we will use the p-value for the model coefficients. If the p-value is less than 0.05, then we can reject the null hypothesis and accept the alternative hypothesis (research hypotheses are equivalent to alternative hypotheses in the language of statistical hypotheses), which means that the research hypothesis is true.

To ensure that the models are valid, it is necessary that the residuals meet the assumptions of Ordinary Least Squares (OLS) (Gujarati and Porter, 2009; Stock & Watson, 2020). The assumptions and tests used for each case are presented below.

A. Lack of correlation between residuals and independent variables of the model:

To identify possible problems of incorrect specification of the selected model, the RESET test is used (Ramsey, 1969; 1974). Recent studies, such as those conducted by Baltagi (2005), demonstrated the importance of the RESET test in increasing the reliability of econometric models by identifying specification errors. The basic hypothesis is: The selected model has no specification errors.

The Fisher statistic is used to test the hypothesis.

B. The model residuals are uncorrelated with each other (autocorrelation):

The error terms must be independent of each other. If they are not independent, then we have a problem known as autocorrelation. To test whether this assumption is met or not, we use the Breusch-Godfrey test (Asteriou and Hall, 2011). The basic hypothesis is: There is no correlation between the residual terms $\left(cov(u_i, u_j) = 0\ for\ i \neq j\right)$.

Fisher or Chi-square statistics are used to test the hypothesis. If the observed test value is greater than the critical value, then the base hypothesis is rejected.

C. The residuals have constant variance (no heteroscedasticity):

The error term must have a constant variance distribution. If the distribution of the error term differs for each observation or set of observations, then we have heteroskedasticity. To test whether this assumption is met, we use the Breusch-Pagan test (Breusch and Pagan, 1979). Recent studies, including those by Cameron and Trivedi (2005), have highlighted the significance of identifying heteroskedasticity in regression models and the effectiveness of the Breusch-Pagan test in addressing this concern. The null hypothesis is: The residuals have constant variance (no heteroskedasticity).

Fisher or Chi-square statistics are used to test the hypothesis. If the observed test value is greater than the critical value, then the null hypothesis is rejected.

D. The error term has a normal distribution:

Having assumed that the observations of the error terms are independent from a distribution with zero mean and constant variance, we now specify the shape of the distribution. The basic hypothesis is: The residuals have a normal distribution ($u_i \sim N(0, \sigma^2)$).

The Jarque-Bera statistic is used to test the hypothesis (Jarque and Bera, 1980). The Jarque-Bera statistic is used to test the hypothesis (Stock and Watson, 2020).

5. Hypothesis testing rule

In this study, hypothesis testing is conducted using the p-value approach. If the p-value is less than the chosen significance level (typically 5%), the null hypothesis is rejected in favor of the alternative hypothesis. Table 1 presents the estimated regression models and the results of all validity checks. Each model examines the relationship between different types of technology use and student engagement in mathematics. The dependent variable across all models is activation in mathematics. The independent variables are entered one at a time to assess their individual impact. All estimated relationships are positive, indicating that the various forms of technology use have a positive effect on student engagement. The F-statistics for all models are significant at the 1% level, and the explanatory power of the models (R^2) ranges from 72% to 82%, suggesting that the models are statistically sound and explain a substantial portion of the variance in student engagement. These results confirm the validity of the tested research hypotheses. Based on the p-values of the tests presented in Table 2, it turns out that for the five models we have evaluated, the assumptions of the Ordinary Least Squares (OLS) method are met, and consequently, the estimates are Best Linear Unbiased Estimates (BLUE). Thus, the models can be used for further analysis; in our case, they will be used to verify the research hypotheses.

Table 1: Estimated regression models for student engagement in mathematics

	Model (1)	Model (2)	Model (3)	Model (4)	Model (5)
Technology use	0.22***(0.06)				
Use of applications (theory)		0.30***(0.05)			
Use of applications (practice)			0.31***(0.05)		
Use of computer programs (theory)				0.32***(0.05)	
Use of computer programs (practice)					0.38***(0.05)
Constant	2.61***(0.20)	2.35***(0.18)	2.32***(0.18)	2.24***(0.17)	2.03***(0.19)
Observations	300	300	300	300	300
R^2	0.75	0.72	0.82	0.74	0.77
Adjusted R^2	0.74	0.71	0.81	0.73	0.76
Residual std. error	1.08	1.04	0.94	1.03	1.01
F-statistic (df = 1; 298)	13.23***	33.60***	36.55***	43.43***	52.41***
Research hypotheses and results					
Hypothesis	RH1	RH2	RH3	RH4	RH5
Result	True	True	True	True	True

Values in parentheses are standard deviations; ***: p<0.01

Table 2: The test results

Model	Reset test	Breusch-Godfrey	Breusch-Pagan	Jarque Bera
1	0.297(0.743)	0.003(0.95)	3.5(0.061)	1.46(0.48)
2	0.908 (0.404)	0.376(0.539)	3.3(0.069)	2.13(0.343)
3	0.283(0.753)	0.241(0.623)	2.04(0.15)	2.69(0.25)
4	0.559(0.571)	0.004(0.951)	1.04(0.45)	0.539(0.763)
5	0.891(0.411)	0.205(0.65)	3.46(0.062)	2.258(0.323)

Values in parentheses are p-values

To test the research hypotheses, we use the p-values of the coefficients of each model, presented in Table 1 (this is expressed by the number of stars accompanying the corresponding estimate). The p-values are smaller than the significance level of 5%, and consequently, the null hypothesis (that the relationship is not significant) is rejected. Thus, the alternative hypothesis, which is consistent with our research hypotheses, is accepted as true. In conclusion, we can say that our research hypotheses are true, which is also expressed in the last row of Table 1.

6. Analysis of variance (ANOVA)

To test whether factors such as technology use, application use for theory, application use for practical, software use for theory, and software use for practical have a statistically significant impact on the dependent variable “activation in math,” ANOVA can be used (Eiselen and van Huyssteen, 2023). The hypotheses to be tested are as follows:

H0: Technology use and other factors (applications and software for theory and practice) do not have a significant impact on the dependent variable “activation in math.”
H1: Technology use and other factors (applications and software for theory and practice) have a significant impact on the dependent variable “activation in math.”

If hypothesis H0 is rejected, this means that the impact of the factors on the dependent variable is statistically significant. The results obtained from the ANOVA are presented in Table 3. All factors included, such as the use of technology, the use of applications for theory, the use of applications for practices, the use of computer programs for theory and the use of computer programs for practices, have a statistically significant impact on the dependent variable “activation in math,” as the p-values for all factors are less than 0.05. The factors 'use of computer programs for theory' and 'use of technology' have a stronger impact than the other factors, as they have higher F-values and very low p-values. In conclusion, based on ANOVA and regression analysis, it is found that the use of technology, especially mobile applications and computer programs to teach theoretical and practical concepts, has a significant positive impact on student engagement during mathematics lessons. This suggests that technology can be a very effective tool to increase student motivation and engagement, as well as to improve teaching and learning outcomes.

7. Conclusions

This study has shown that the use of technology, especially mobile applications and educational software, has a positive impact on students' academic performance, as well as their motivation and engagement in learning mathematics. The results analyzed have proven that students who use these technological tools tend to have better results in mathematics tests and exams, compared to those who do not use them. This suggests that technology can provide a more interactive and engaging learning experience, making learning clearer and easier to understand, especially when dealing with abstract and difficult concepts. Furthermore, the use of technology has helped develop students' critical and analytical skills, encouraging them to think more deeply and engage in solving mathematical problems. Educational applications and programs provide opportunities to practice and repeat material in ways that are more interesting and effective than traditional teaching methods.

However, this study has also shown that in order to maximize the benefits of using technology, certain conditions and preparations are necessary. Many students and teachers still face challenges related to poor technological infrastructure, lack of appropriate equipment, and the need for specialized training in the effective use of applications and software. This is especially true for schools and universities located in more remote areas or with more limited resources. For this reason, it is important that educational policies and educational institutions invest more in technological infrastructure and in the training of teachers and students in the use of these tools. It is also imperative that educational applications and platforms are designed in a way that is appropriate for the different needs and levels of students, providing sufficient support and opportunities for continuous development.

In conclusion, this study has highlighted that technology has the potential to improve mathematics learning and education in general, offering opportunities for deeper engagement and improved academic results. However, to achieve its successful integration into the Albanian education system, it is necessary to take immediate measures to address the challenges and create a more suitable environment for the use of technology in teaching. This study is only a first step in analyzing the impact of technology on Albanian education and provides a basis for further research in this area.

This study has highlighted the significant benefits of using technology, particularly mobile applications and educational software, in enhancing students' academic performance, motivation, and engagement in mathematics. However, to fully leverage these advantages, it is crucial to tackle several challenges, including insufficient technological infrastructure, a lack of proper equipment, and the necessity for specialized training for both educators and learners. For technology to achieve optimal outcomes, educational policies and institutions need to invest more in improving technological infrastructure and creating training programs that empower both teachers and students to effectively utilize educational tools and applications.

Table 3: The ANOVA results

	DF	Sum Sq.	Mean Sq.	F-value	Pr(>F)	Sig.
Use of technology	1	15.44	15.442	15.147	0.000127	***
Use of applications for theory	1	26.34	26.340	25.837	0.000000	***
Use of applications for practical	1	6.01	6.008	5.893	0.015885	*
Use of computer programs for theory	1	5.68	5.681	5.572	0.018997	*
Use of computer programs for practical	1	4.58	4.577	4.489	0.035071	*
Residuals	257	262.01	1.019			

DF: Degree of freedom; Sum Sq.: Sum of squares; Mean Sq.: Mean square; *: p < 0.1; ***: p < 0.01

Moreover, it is essential that educational applications and platforms are developed with an understanding of the diverse needs and skill levels of students, providing adequate support and opportunities for ongoing growth. Future research should involve longer observation periods and larger samples of educational institutions to gain a clearer insight into the long-term effects of technology on mathematics education and the enhancement of students' critical thinking abilities. To successfully integrate technology into the Albanian education system, it is imperative to promptly address current challenges and foster a more supportive environment for technology use in teaching. This study represents an initial effort to examine the impact of technology on Albanian education and lays the groundwork for further exploration in this field. Therefore, a stronger commitment and sustainable investment in technology and training for human resources are essential to develop a more advanced education system with more effective teaching methods.

Compliance with ethical standards

Ethical considerations

Informed consent was obtained from all participants, and confidentiality was maintained. Ethical guidelines were followed throughout the study.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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