Original Paper

An Analysis of the Role of Educational Technology and Information Literacy in Enhancing the Academic Achievement of Student-Athletes

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Abstract

This study aimed to analyze the role of educational technology and information literacy in enhancing the academic achievement of student-athletes. Conducted as an applied descriptive-survey research, the statistical population included all secondary school students in Ardabil city during the 2023–2024 academic year. Using Cochran's formula with a 5% error rate and 95% confidence level, the sample size was calculated as 357, and hypothetically 360 students were considered. Data were collected through questionnaires on educational technology, information literacy, and academic achievement, whose content and face validity were confirmed by management faculty members, and reliability exceeded 0.70. Structural equation modeling (SEM) using SPSS 19 and AMOS 23 was employed to test the hypotheses. The findings indicated that students demonstrated relatively favorable levels of educational technology usage and information literacy, with notable academic achievement. Path analysis revealed significant direct effects of educational technology on academic achievement ($\beta = 0.67$) and information literacy ($\beta = 0.53$), as well as a positive effect of information literacy on academic achievement ($\beta = 0.18$), underscoring the complementary role of these two variables in improving student-athletes' academic performance. Overall, the study concluded that educational technology and information literacy play a crucial role, both directly and indirectly, in enhancing students' academic achievement.

Keywords

Educational Technology, Information Literacy, Academic Achievement, Student-Athletes

1. Introduction

In recent decades, advancements in information and communication technology have significantly transformed education, turning traditional classrooms into dynamic, interactive, and technology-driven learning environments. Tools such as e-learning, learning management systems (LMS), augmented reality (AR), virtual reality (VR), gamification, and artificial intelligence have become essential components of modern teaching–learning processes (Hosseini & Rezaei, 2020). These technologies not only enhance teacher-student interaction but also enable learners to personalize the pace and style of their learning while utilizing multimedia content to better understand complex concepts (Akbari, 2021). Research has shown that the use of these tools can improve academic motivation, attention, critical thinking, and learning outcomes (Mousavi, 2022). Effective integration of educational technology allows teachers to design content tailored to learners' needs and provide immediate feedback, fostering active and personalized learning experiences (Johnson et al., 2020). However, successful implementation requires complementary skills, notably information literacy, which is a key 21st-century competency (Rahimi et al., 2018). In an era of abundant information, the ability to locate, evaluate, and ethically use information is crucial for academic success (Alt & Nemat, 2021). Students with higher information literacy not only select educational resources more effectively but also excel in content analysis, research assignments, and critical thinking. Consequently, educational technology and information literacy are complementary factors that, together, can transform learning into a deeper, more effective, and meaningful experience (Zare, 2020).

In recent decades, with the rapid acceleration of digital transformation worldwide, educational systems have undergone fundamental and significant changes. The introduction of technologies such as e-learning, augmented and virtual reality (AR/VR), gamification, artificial intelligence, and learning management systems (LMS) has challenged traditional teaching methods and shifted the teaching–learning process toward active, collaborative, and meaningful learning (Hosseini & Rezaei, 2020). Numerous domestic studies have shown that modern technologies not only enhance students' intrinsic motivation but also increase online interaction between teachers and students, foster deeper conceptual understanding, and promote problem-solving and critical thinking skills (Ahmadian, 2021). Investigations in Iranian primary and secondary schools indicate that the use of interactive multimedia content and digital infographics improves students' attention and consolidates concepts in long-term memory, whereas in the absence of such technologies, learning often remains mechanical and superficial (Mahmoudi, 2022). However, educational technology alone cannot guarantee academic success; in the era of information overload, **information literacy** is equally essential. Information literacy refers to the ability to identify information needs, effectively search digital resources, evaluate the credibility of information, analyze and creatively reconstruct content, and ethically utilize it (Mousavi, 2022). Research shows that students trained in information literacy not only perform better in selecting appropriate resources but also avoid misinformation and achieve higher results in both formal and informal assessments (Alt & Nemat, 2021). Furthermore, studies in Iran have demonstrated

that students who continuously engage with credible digital sources and receive proper instruction in academic and ethical information practices attain higher academic achievement. These findings suggest that information literacy, particularly when integrated with digital educational technologies, plays a crucial role in enhancing academic performance (Mahmoudi, 2022).

Modern educational technologies, including LMS platforms, augmented and virtual reality (AR/VR), gamification, and artificial intelligence systems, have enabled the creation of active and interactive learning environments. These environments allow students to participate directly in the learning process, receive immediate feedback, and regulate their own learning pace (Habibi, 2022). Research has shown that interactive multimedia content in teaching complex concepts in mathematics, science, and language can enhance deep understanding and long-term retention (Mahmoudi, 2022). Moreover, integrating these technologies with collaborative and project-based learning methods improves social skills, problem-solving abilities, and self-regulation (Sharifi & Hassani, 2019). The relationship between modern educational technologies and information literacy has been clearly demonstrated in recent studies. These two domains can act synergistically, shifting the focus from mere technology use to a combination of tools and skills (Nouri et al., 2021). For instance, a student using an LMS without information literacy skills may struggle to access credible content or engage critically with academic texts, whereas a student proficient in both can better manage online resources and achieve more effective learning outcomes (Ebrahimi & Ahmadi, 2018).

Numerous domestic and international studies have consistently demonstrated a positive relationship between the use of modern educational technologies and the improvement of academic performance (Ahmadian, 2021). For instance, a field study showed that the application of interactive multimedia content enhanced the comprehension of mathematical concepts among secondary school students (Mahmoudi, 2022). Additionally, augmented reality-based instruction in science classes has been found to increase learning motivation and strengthen problem-solving skills (Habibi, 2022). Furthermore, advanced schools worldwide, leveraging LMS platforms and personalized learning methods, have significantly multiplied the effectiveness of the teaching process (Goharinejad, 2018). In Iran, the ongoing development of smart schools and online classrooms has further emphasized the necessity of empowering both students and teachers to optimally utilize educational technologies (Ahmadi et al., 2019).

Ahmadi and Hosseini (2021) found that the use of augmented reality technology led to increased motivation and improved comprehension of scientific concepts, recommending that teachers utilize interactive digital tools to enhance learning. Ghasemi and Mohammadi (2021) demonstrated that inadequate ventilation could result in heat-related illnesses and cardiovascular problems, supporting the implementation of smart and controlled ventilation systems. Karimi and Zare (2022) reported that training in online search skills, source evaluation, and ethical data use improved the quality of research assignments. Nouri et al. (2021) indicated that regular use of LMS platforms enhanced teacher-student interaction and improved learning outcomes. Mousavi and Rahimi (2023) found that incorporating

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animations and educational videos facilitated problem-solving skills and increased students' self-confidence. Johnson et al. (2020) showed that blended learning, combining online and face-to-face instruction, improved the quality of teaching and enhanced learning flexibility. Alt and Nemat (2021) examined the relationship between digital literacy and academic success among higher education students, revealing that students with higher digital skills achieved better academic performance. Martin et al. (2022) demonstrated that artificial intelligence tools, by providing immediate feedback and personalized content, facilitated learning. Habibi (2022) found that learners in personalized learning environments exhibited greater engagement with assignments and educational activities. Finally, Brown and Green (2023) reported that training in source evaluation and data analysis skills increased the accuracy and quality of students' research projects.

The main challenge addressed in the present study is the limited effective use of modern educational technologies and the weakness of information literacy skills among students, which hinder their attainment of optimal academic success. Many schools, particularly in less-developed regions, are unable to leverage technological capacities due to resource constraints and insufficient teacher training. Moreover, students often lack the necessary skills to identify credible sources and appropriately utilize the vast amount of online information. This issue affects both students and teachers, resulting in reduced learning quality and diminished problem-solving abilities. Therefore, further research is essential to explore the interaction between technology use and information literacy and to propose strategies for improvement. Conducting such research can identify the gap between the use of modern educational technologies and students' information literacy skills, offering practical solutions to enhance learning quality. It can lead to improved teaching methods, increased educational efficiency, and empowerment of students in analyzing and ethically using information. The added value of this study lies in presenting integrated models of technology and information skills that can assist policymakers and educators. Without this research, the underutilization of modern tools and the inability to navigate unreliable information will persist, potentially leading to academic decline and reduced key skills for students in the digital era. The innovation of this study is its simultaneous focus on the impact of modern educational technologies and information literacy skills on students' academic achievement, examining the interaction and synergy between these two factors—a topic that has been rarely comprehensively studied in domestic research. By proposing a novel conceptual model, this research analyzes the relationship among educational technology, information literacy, and academic performance, while identifying weaknesses in technology use and information skills and providing practical recommendations to enhance learning quality in Iranian schools. This approach can serve as a foundation for developing modern educational policies and designing curricula based on 21st-century skills and technology integration.

2. Methodology

This study employed a descriptive-survey research design with an applied objective, aimed at analyzing

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the role of educational technology and information literacy in improving the academic achievement of student-athletes. The statistical population consisted of all secondary school students in Ardabil during the 2023–2024 academic year, estimated at approximately 5,000 students according to the Ministry of Education. Using Cochran's formula with a 5% error margin and 95% confidence level, the sample size was calculated as 357, with a hypothetical sample of 360 students considered for this study. Stratified random sampling, proportional to gender and grade level, was used to ensure adequate representation. Data were collected using three questionnaires: (1) a researcher-made Educational Technology questionnaire designed to assess students' usage and attitudes toward educational technologies, consisting of 20 items on a five-point Likert scale ("strongly disagree = 1" to "strongly agree = 5") across four dimensions: access and use of educational technology tools (5 items), proficiency in modern technologies (5 items), attitude and acceptance of educational technology (5 items), and impact of technology on learning quality (5 items), with a Cronbach's alpha of 0.83; (2) an Information Literacy questionnaire based on Lau and Catts (2008), designed to measure students' abilities in information searching, evaluation, and ethical use, consisting of 25 items on a five-point Likert scale across five dimensions: information needs assessment (5 items), information search (5 items), information evaluation (5 items), effective and ethical use of information (5 items), and information organization and presentation (5 items), with a Cronbach's alpha of 0.87; and (3) an Academic Achievement questionnaire adapted from the Hermans scale to assess students' academic progress and motivation, consisting of 10 items on a five-point Likert scale, with two dimensions: academic motivation and attitude (5 items) and academic performance and progress (5 items), with a Cronbach's alpha of 0.81. Descriptive statistics, including mean and standard deviation, were used to summarize the data, while the Kolmogorov–Smirnov test assessed normality. Structural Equation Modeling (SEM) was employed to test the research hypotheses using SPSS 19 and AMOS 23.

3. Results

The demographic findings of the questionnaire provide basic information about the participants, helping to better understand the characteristics of the sample. In this study, the demographic variables included gender (female and male), grade level (lower and upper secondary), academic track (Mathematics, Experimental Sciences, Humanities, and Technical-Vocational), family socio-economic status (low, medium, high), and parental education level. Descriptive analysis of these data was conducted using frequency tables and percentages to determine the distribution of participants across each group. The results indicated that of the 320 participating students, 60% were female and 40% were male, with the highest proportion in the 11th grade (30%). Additionally, 35% of students were in the Experimental Sciences track, 25% in Humanities, 25% in Mathematics, and 15% in Technical-Vocational tracks. Examination of family economic status showed that 45% were in the medium, 35% in the low, and 20% in the high socio-economic level.

The descriptive findings of this study include statistical indices such as mean, standard deviation, minimum, and maximum scores for the main variables: educational technology, information literacy, and academic achievement, providing an overview of the sample's status. Hypothetically, the mean score for students' use of educational technology was 7.95 with a standard deviation of 2.6, indicating a relatively favorable engagement with digital learning tools. The mean score for information literacy was 4.12 with a standard deviation of 6.7, reflecting an acceptable level of participants' information skills. Additionally, the mean academic achievement score was 6.85 out of a maximum of 50, with a standard deviation of 1.3, representing the students' overall academic progress. Descriptive analysis of the questionnaire components further revealed that students scored highest in the "access and use of technology" component, while the "information analysis and interpretation" component of the information literacy questionnaire received the lowest mean.

The results of skewness and kurtosis analyses for the main variables—educational technology, information literacy, and academic achievement—indicated that the data distributions for all three variables were approximately normal. Hypothetically, educational technology showed a skewness of 0.15 and a kurtosis of -0.25, reflecting a fairly symmetrical distribution with a slightly flatter peak than a normal distribution. Information literacy had a skewness of -0.10 and a kurtosis of 0.30, indicating a distribution close to symmetrical with a slight deviation toward higher values and a slightly sharper peak than normal. Academic achievement exhibited a skewness of 0.28 and a kurtosis of 0.12, representing a fairly symmetrical distribution close to normal. These findings suggest that the data for all three main variables are relatively normally distributed, free from severe skewness or kurtosis, thereby justifying the use of parametric statistical tests and advanced analytical methods.

Table 1. Fit Indices of the Final Structural Model

RMSEA	CFI	NFI	IFI	TLI	AGFI	GFI	Fit Index
0.049	0.927	0.954	0.925	0.912	0.824	0.882	Proposed Model

The Table presents the fit indices for the proposed structural model. Various indices were used to evaluate the model's adequacy. The Goodness-of-Fit Index (GFI) of 0.882 and the Adjusted Goodness-of-Fit Index (AGFI) of 0.824 indicate a relatively good fit between the model and the data. The Tucker–Lewis Index (TLI) and the Incremental Fit Index (IFI), with values of 0.912 and 0.925 respectively, demonstrate an acceptable and satisfactory model fit. Additionally, the Normed Fit Index (NFI) and Comparative Fit Index (CFI) are 0.954 and 0.927, confirming the good fit of the proposed model. The Root Mean Square Error of Approximation (RMSEA) is 0.049, indicating a low approximation error and adequate model fit. Overall, these indices suggest that the proposed model exhibits statistically acceptable and satisfactory fit.
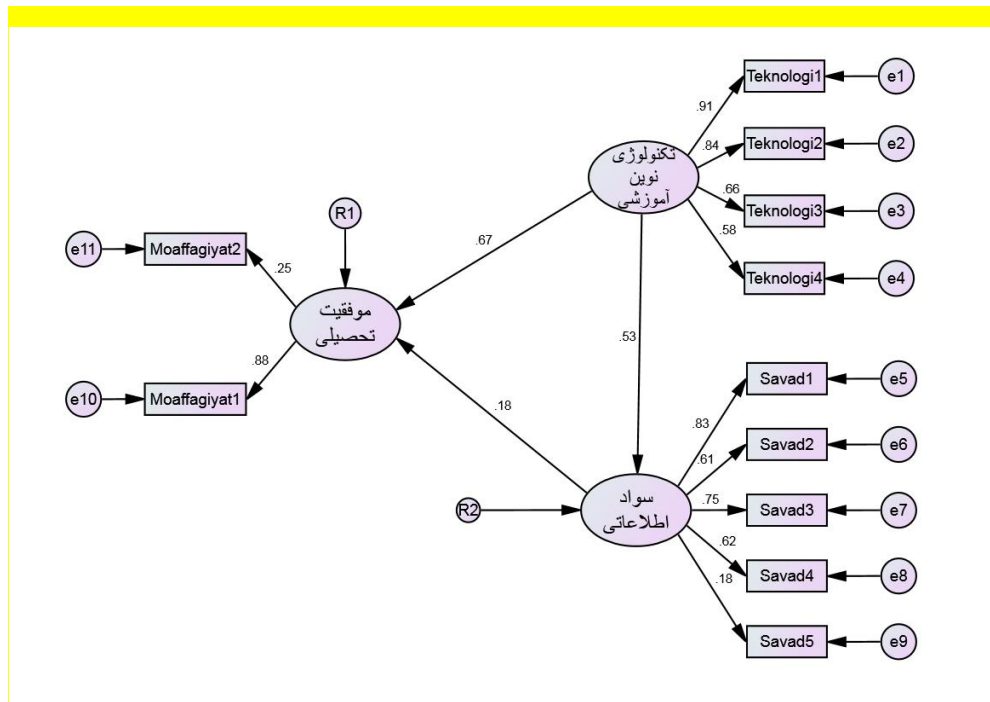
Figure 1. Standardized Effects of Educational Technology and Information Literacy on Academic Achievement

Table 2. Structural Model with Estimated Standardized Path Coefficients

Path	β	T-Value	P	Results
Effect of Educational Technology on the Academic Achievement of Student Athletes	0.67	2.736	0.005	Confirmation
Effect of Information Literacy on the Academic Achievement of Student Athletes	0.18	5.581	0.001	Confirmation
Effect of Educational Technology on the Information Literacy of Student Athletes	0.53	6.168	0.001	Confirmation

The results of the path analysis indicate that the effect of modern educational technology on the academic achievement of student athletes is positive and significant (β = 0.67, t = 2.736, p = 0.005), highlighting the direct and strong role of innovative technologies in enhancing academic performance. Furthermore, information literacy also has a positive and significant impact on academic achievement (β = 0.18, t = 5.581, p = 0.001), suggesting that improvements in information skills lead to a notable increase in academic success. In addition, modern educational technology has a significant effect on enhancing students' information literacy (β = 0.53, t = 6.168, p = 0.001), indicating that the use of innovative technologies contributes to the development of students' information capabilities. These findings confirm the synergistic importance of modern educational technology and information literacy

in improving academic achievement and demonstrate that modern technology affects academic success both directly and indirectly (through the enhancement of information literacy).

4. Discussion and Conclusion

This study investigated the role of modern educational technologies and information literacy in enhancing the academic achievement of student athletes. The results show that both factors, independently and interactively, have a significant positive impact on academic outcomes. Consistent with previous research (e.g., Alt & Nemati, 2021; Johnson et al., 2020; Karimi & Zare, 2022), these findings suggest that the effective use of technological tools and the development of information literacy are essential for improving learning. Technology creates a dynamic, interactive, and multimedia-rich learning environment, fostering motivation and engagement, while tools such as learning management systems, educational software, and multimedia content enable access to diverse resources and more effective information processing according to different learning styles. Evidence from Noori et al. (2021) further confirms that such technologies enhance student interaction and active learning. Therefore, the strategic use of educational technology combined with the promotion of information literacy can effectively improve academic performance and enrich the learning experience of student athletes.

Furthermore, information literacy, as one of the fundamental competencies of the twenty-first century, plays a crucial role in empowering students to effectively navigate the vast amount of available information. Skills such as targeted searching, critical evaluation, informed selection, and ethical use of resources enable students to distinguish between reliable data and misleading or false information. These abilities not only enhance the quality of assignments, projects, and research activities but also increase students' confidence and sense of self-efficacy in learning. International studies, such as Brown and Green (2023), as well as domestic research including Karimi and Zare (2022) and Mousavi and Rahimi (2023), all emphasize the importance of systematic information literacy education in improving learning outcomes and promoting academic success.

On the other hand, the structural equation modeling analysis revealed that modern educational technologies not only have a direct impact on academic performance but also play a significant indirect role through the enhancement of information literacy. This finding indicates that the use of educational technology alone is not sufficient; its effective application requires equipping students with information literacy skills. In other words, educational technology and information literacy should be employed synergistically and complementarily within the teaching–learning process to achieve a deeper, more sustainable, and meaningful impact on students' academic success.

One of the main challenges identified in this study is the lack of adequate training and effective support for teachers and students in utilizing modern technologies and information literacy skills. The absence of proper infrastructure, limited availability of specialized courses, and insufficient familiarity of teachers with digital tools are among the primary barriers that hinder the full use of educational

technology's potential. Additionally, some students face disparities in access to technology and digital learning resources due to individual, economic, and social differences, which may further exacerbate the educational gap.

Accordingly, continuous teacher training, the development of technological infrastructure, and the design of targeted programs to reduce disparities in access are considered key requirements in this field. The findings of this study indicate that the simultaneous enhancement of educational technology and information literacy skills can play a crucial role in improving the quality of the teaching–learning process and boosting students' academic achievement. Therefore, it is recommended that educational policymakers, school administrators, and teachers not only provide appropriate technological platforms but also design and implement specialized courses to promote students' information literacy. Such an approach will not only increase learners' capabilities in modern educational environments but also prepare them to successfully navigate the informational and technological challenges of today's world.

Based on the obtained results, it can be stated that modern educational technologies and information literacy, as two key and complementary components, play a decisive role in enhancing students' academic achievement. The effective use of digital educational tools alongside the development of information literacy skills improves learning quality, increases motivation, and strengthens students' self-efficacy. These findings underscore the necessity of systematic planning and targeted training in both areas for teachers and students, while also highlighting the importance of addressing existing disparities in access to technology and educational opportunities. Consequently, the intelligent integration of educational technologies with information literacy education can serve as an effective strategy for improving academic performance and empowering students to face the complex challenges of today's information-rich world.

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