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E-learning, Computer-Aided Learning Tools, and Software in Physical Education Pedagogy for Cultivating Teaching Excellence

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Abstract: *The significance of this article lies in the transformative impact of computer information technologies and electronic learning (hereinafter "e-learning"), offering numerous advantages. The primary objective is to underscore the benefits of integrating information technologies and e-learning for creating multimedia content in physical education courses. This integration occurs within an e-learning platform, emphasising its role in shaping teaching excellence. The Internet has greatly accelerated educational development, providing diverse learning opportunities anytime and anywhere. While e-learning has become a prominent educational trend, particularly in reducing the burden on teachers, existing systems primarily focus on general subjects such as linguistics, mathematics and management. Notably, the field of physical education deserves attention in the e-learning landscape, given the pivotal role of athletic training in daily life. The article outlines the role of e-learning in enhancing teaching excellence. It describes the use of e-learning platforms and software in physical education pedagogy. Finally, the article explores the application of computer technologies, automated learning and software in this field.*

Keywords: *electronic learning; sports training; 2D/3D animation and digital video; computer-aided learning tools; automated learning; software.*

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1. Introduction

Incorporating e-learning systems and technologies into the educational framework significantly enhances individual media competence. The widely embraced term “e-learning” (short for electronic learning) effectively combines various concepts within the latest educational technologies, predominantly relying on the extensive use of information communication technologies (ICT) and innovative information learning methods. Students can acquire relevant knowledge and skills by engaging with virtual laboratories and gaining practical experience within a simulated environment.

Learning encompasses a didactic process that employs a comprehensive array of computer and other information processing tools in the context of new information technologies. This approach systematically organises optimal interaction between teachers and students, aiming for a guaranteed pedagogical outcome.

Ukrainian and foreign researchers have extensively explored the problem in question. Notably, Ukrainian scholars such as Klopov (2012), Konovalchuk (2015), and Matviichuk (2015) have conducted studies demonstrating the effectiveness of e-learning. Their findings support that e-learning is effective, incorporating extensive multimedia and hypermedia, and enabling remote access to distributed educational resources through web technologies. Additionally, these studies highlight using various networked tools for interaction among students and with the teacher, resulting in positive outcomes.

Rafiq, Triyono and Djatmiko (2022) prove that the 21st-century curriculum for physical education classes should integrate multimedia information technologies, including components such as videos, flash animations, and 3D virtual reality (VR) models. According to such findings, this additional content significantly enhances the acquisition of exercise techniques. Furthermore, Ahsan (2024) provide evidence supporting the advantages of electronic manuals in physical education, emphasising the incorporation of multimedia information technologies. Elmi et al. (2024) emphasise that multimedia information technologies not only stimulate the learning environment but also serve as a source of inspiration for students, fostering active participation. They believe that the unique attributes of multimedia technologies contribute to their effectiveness, offering a learning experience that may not be achievable through alternative means.

Therefore, the article aims to 1) define the role of e-learning in developing teaching excellence, 2) present experiences with e-learning platforms and software in physical education pedagogy, and 3) highlight how computer technologies, automated learning, and software contribute to advancing teaching excellence in physical education.

2. E-learning in the Context of Developing Teaching Excellence

The term “e-learning” smoothly substitutes the commonly used term “distance learning,” which essentially denotes the technology of accessing educational resources remotely. E-learning more accurately captures the trend of extensive and inclusive use of media-educational technologies across full-time, evening, and part-time educational formats. It signifies the comprehensive integration of automated (computer-based) learning technologies with traditional ones.

Indeed, e-learning encompasses the extensive use of multimedia and hypermedia, enabling remote access to distributed educational resources through web technologies. It involves incorporating diverse network tools facilitating interaction among students and between students and the teacher (Kravchuk, 2007).

E-learning integration into the educational process inherently enhances one’s media competence, encompassing both the teacher, who employs educational technologies, and the student, who engages with new information learning technologies. The e-learning system, serving as an information-communication software-hardware environment, acts as a pedagogical tool that fosters the development of students’ skills and becomes a subject of study. According to Oyetade, Harmse, and Zuva (2023), irrespective of the discipline being studied, students acquire and enhance knowledge, skills, and abilities related to media technologies through the use of e-learning systems.

E-learning systems offer the capability to deliver educational content to students in the form of a well-structured and systematically organised set of media data. This educational content comes in various types of presentation, including text, visual elements, and audio information. Concurrently, information communication technologies enable the integration of hypertext, graphics, animation, video, and audio data into cohesive information material. This results in the provision of multimedia interactive learning content for users (Bain, 2004).

Importantly, e-learning systems serve as powerful multimedia tools integrated into the conventional educational activities of institutions, facilitating both classroom instruction and students' independent study. These systems play a crucial role in shaping an interdisciplinary virtual knowledge space, thereby enhancing the efficiency of media technology use in education. The widespread adoption of e-learning systems can be linked to their main benefits following the latest communication technologies that rely on digital tools. As noted by some scholars (Bielski, 2000; Matviichuk, 2015) these tools help organise interactive differentiated learning with the use of global educational resources and do not depend on the location of students. They also allow monitoring of the effectiveness of the educational process and expected learning outcomes automatically. Furthermore, they stimulate communication among all the actors in the education process. Finally, they provide the possibility to deal with multimedia data and ensure educational interaction by means of virtual landscapes (chats, forums, e-mails).

3. Exploring the Impact of E-Learning Platforms and Software on Physical Education Pedagogy to Achieve Teaching Excellence

An effective e-learning platform for physical education integrates diverse curricula enriched with multimedia elements such as 2D/3D animation and digital video. Given that physical education shares similarities with various fields such as philology, management, and business, the incorporation of computer multimedia greatly promotes e-learning in physical education. In the context of teaching excellence in physical education pedagogy, one of the objectives of e-learning and software is to emphasise fundamental cinematic movement training. This involves using videos to show and teach essential cinematic movements, aiding in athletic skills acquisition.

The implementation of sports ethics relies on perception, necessitating that players possess knowledge and comprehension of exercise rules. To enhance students' understanding of exercise rules and sports ethics, these rules can be presented in the form of Level 2 animations. Therefore, an essential aspect of this research is the cultivation of sports ethics among players and the acquisition of diverse sports rules to prevent unfavourable situations during competitions. Given the unpredictable nature of sports, the e-learning platform also provides first aid courses, which can be demonstrated using 3D VRML, ensuring players are prepared for unforeseen incidents during racing games or practice (Naumchuk, 2010).

Typically, this process involves course mapping, software design, and instructional design, with potential assistance in system design and development. Drawing on the ADDIE model concept, most policy guidelines can be taken into account, particularly in the context of multimedia training programs for physical education instruction. Using learning tools such as video, drawings or animations proves more effective than relying solely on text.

In physical education, employing video classes is a valuable tool. Video content serves as a resource to be integrated into an online physical education e-learning platform. In turn, a teacher or coach can directly demonstrate movements to students, providing a visual explanation and repeating basic actions or addressing specific challenges at a pace suitable for effective learning.

Allowing students to learn the course independently through the presentation of examples with voice instructions and video scenes can be highly effective. Regularly testing motor skills and offering diverse styles of instruction are crucial as students master athletic skills. Computer multimedia, with its diverse characteristics, can effectively meet the teaching and learning requirements.

Therefore, a training program that incorporates multimedia elements for sports applications can evoke emotional responses and enhance students' motivation and eagerness to learn.

Multimedia course programs serve a supportive role by assisting teachers and providing students with various learning aids beyond the classroom setting. In a multimedia environment, this has the potential to increase students' interest and enthusiasm for learning (Drakenberg, 2001).

Students are introduced to a captivating world, including elements of virtual reality, encompassing computers, text, sound, images, animation, and visual media. This illustrates an innovative approach to interactive graphics and digital content from various platforms that hold student's interest. As a result, it is vital to create a dynamic learning environment to encourage students to be fully immersed in the educational process. It can also help improve their comprehension and reading skills.

4. Using Technological Advancements in the Field of Physical Education

In physical education, technological advancements involve software solutions, electronic hardware, and tools that are based on computational frameworks. These mechanisms rely on up-to-date systems for transferring information and, thus, simplify processes associated with different processes within digital network systems. The educational process is enriched by the combination of IT and traditional instructional methods. In the field of physical education, the integration of software and educational methodologies is essential for enhancing the learning experience and nurturing the personal growth of learners. According to Oyetade, Harmse, and Zuva (2023), recent advancements have been developed from a multimedia technology standpoint. It allows users to use the interactive features of IT.

The significance of computer technologies in physical development lies in their foundation on speed and universality. The system, structured around coding and information transmission methods, enables the swift performance of diverse tasks in the briefest possible timeframe. Digital technologies simplify the organisation of training processes, allowing for more efficient and prompt monitoring and analysis of athletes' actions.

Sparking interest in physical education among young individuals is easily achievable through digital and innovative technologies in educational and training processes. In the current landscape, many technical innovations prove beneficial, particularly in the realm of physical education, and are especially relevant in the context of distance learning. The latest surveillance systems contribute to more precise monitoring and analysis of the training process. Diagnostic equipment with recording devices for subsequent analysis and correction of training techniques enhances control over one's condition during workouts. Tensiometric devices find widespread use in recording support reactions during physical exercises, while automated control systems are integral in team sports. Diagnostic equipment not only facilitates a comprehensive analysis of physical activity but also aids in selecting the most effective means and methods to enhance sports performance (Rafiq, Triyono & Djatmiko, 2022).

In the field of physical education and sports activities, sports equipment infused with digital technologies has gained widespread popularity. Notable examples include the "smart" ball, which assists in refining striking techniques and power, transmitting information to a computer for later review of trajectory, impact force, and other parameters. Similarly, "smart" dumbbells can calculate the number of calories burned during training, guiding the load distribution based on light indicators.

Smart balls are equipped with sensors to monitor various aspects of physical activity. Their key components include the following: a) *accelerometers and gyroscopes*, which determine speed, trajectory, and rotation; b) *Bluetooth or Wi-Fi modules*, which transmit data to smartphones or tablets; c) *impact sensors*, which analyse the force of impact and interaction angles; d) *mobile applications*, which visualise data and offer instructions or training programs.

The limitations of such balls include their high cost (ranging from \$150 to \$300), which restricts accessibility, along with the requirement to learn and interpret the application's data, a short battery life, and the need for frequent recharging.

Smart dumbbells incorporate electronics for monitoring strength, frequency, and exercise quality. Pressure and force sensors measure exertion during lifts, whereas screens and LED indicators offer immediate updates on one's performance. Using mobile app integration facilitates data assessment and the design of training modes. A significant drawback is the expense, with some smart dumbbells priced between \$300 to \$700.

The benefits of using smart technologies include the personalisation of exercise modes, the ability to track progress, and integrated challenges that serve to enhance motivation. The ongoing development of these technologies has the potential to improve their availability in the future (Rafiq, Triyono & Djatmiko, 2022).

Modern technology has become deeply embedded in various fields, including sports. Shoes that have built-in sensors can track weight, balance pressure and evaluate movement metrics. The iWatch and other smartwatches are essential for tracking one's health during workouts, as they monitor heart rate, breathing, blood pressure, etc. They also allow one to download sports apps that can assist one during training sessions. These devices enable users to track their health status and tailor the intensity of exercises accordingly. Notably, the Workout app calculates burned calories and the distance covered during training sessions (Ráthonyi et al., 2018).

Another digital innovation is the smart scale, capable of not only measuring weight but also various other physiological indicators of the body. In sports practice, the integration of digital technologies significantly contributes to cultivating interest and engagement in sports.

The integration of information and communication technologies (ICT) and artificial intelligence (AI) is reshaping traditional pedagogical models, such as Bloom's taxonomy (1956) and Kolb's experiential learning theory (2015). These technologies enhance and adapt these models to meet the needs of today's students, fostering personalised and interactive learning experiences.

Bloom's taxonomy (1956) identifies six cognitive levels of learning, including *knowledge, comprehension, application, analysis, evaluation, and creation*. The integration of technology at each of these levels can enrich the learning process by enhancing accessibility and engagement. Similarly, Kolb's experiential learning theory (2015) comprises four stages, such as concrete learning, reflective observation, abstract conceptualisation, and active experimentation, and becomes more dynamic and interactive through technology.

A major benefit of integrating technology into these models is the ability to individualise the learning experience. Technologies enable the customisation of the educational process to align with each student's unique learning style. Virtual environments and multimedia tools boost engagement, while automated assessment systems provide continuous, real-time feedback. These advancements stimulate interest in learning and motivate students by offering new opportunities for growth and development (Rafiq, Triyono & Djatmiko, 2022).

By incorporating technology, Bloom's taxonomy (1956) and Kolb's experiential learning theory (2015) gain greater flexibility and relevance in addressing current pedagogical challenges. These tools improve learning outcomes by facilitating personalisation, interactivity, and practical application of knowledge, equipping students with the skills to excel in real-world scenarios.

5. Using Automated Learning Tools and Software in Physical Education Pedagogy to Develop Teaching Excellence

Computer technologies, as teaching tools, are developed within the existing educational framework and must align with it. At the same time, they can actively shape changes in teaching methods and the overall educational process.

In physical education, the primary uses of computer technologies include statistical analysis, preparation of methodical documentation, teaching and assessing students' theoretical knowledge,

monitoring participants' physical development and fitness, processing competition results in various sports, optimising movement techniques, and developing computerised training systems.

Electronic educational literature, as a form of educational software, offers a) computer visualisation of learning materials, b) methodical support for the educational process, c) feedback mechanisms for students, and d) monitoring of both theoretical and physical coursework (Koryahin et al., 2020).

The most promising applications of information technologies in university education include educational software, which can be extensively used in physical education classes. These include e-learning aids (e-textbooks, presentations), instructional-methodical complexes, computer-based assessment programs, and visual aids to support various types of classes.

In physical education, widely used electronic resources include e-textbooks, collections, multimedia libraries, electronic reference books, presentations, simulators, tests, and more.

Electronic educational publications should provide well-organised content on the theory and methods of physical education and sports, fostering students' creative and active acquisition of knowledge, skills, and abilities in this field. These resources should demonstrate high standards of design, clarity, comprehensive information, logical flow, and strong methodical support (Prystynskyi et al., 2020).

The e-textbook serves as a key electronic resource, designed to meet both scientific and methodical standards, in alignment with the state educational standard for physical education and sports. As an officially approved learning tool, it presents material in a clear and accessible format, suitable for independent study, and is built using hypertext. The theoretical content includes essential concepts, terms, theories, and principles that clarify the essence of physical education phenomena and the relationships between them, helping to form students' knowledge and skills. The e-textbook's goal is to provide students with the knowledge needed to maintain physical fitness, support health, and encourage lifelong self-improvement through structured physical activities.

The primary advantages of the e-textbook are its interactivity and its ability to be stored electronically or shared via email. It includes not only text but also reference materials, illustrations, video clips, animations, and sections for knowledge assessment. E-textbook software covers broad sections of educational courses and is adaptable for group and individual learning environments (Blazer, 2005).

The e-textbook is designed to facilitate active understanding and memorisation of key concepts, statements, and examples by engaging additional cognitive skills, such as auditory and emotional memory, alongside computer-based explanations. These tools enhance independent learning and improve material acquisition. Supplementary materials broaden students' perspectives, stimulate deeper engagement, and make content more accessible through diverse instructional methods, such as inductive reasoning and adaptive learning, tailored to individual skill levels and intellectual capabilities.

E-textbooks also enable knowledge assessments at different stages of learning and offer opportunities for self-evaluation (Collinson & Ono, 2001).

Creating an e-textbook requires a complete rethinking of both content and structure. The material must be analysed and paired with visual, animated, or video elements. The creation process involves writing text, selecting reference and illustrative content, choosing the instructional program's design, as well as planning interactive elements such as video clips, animations, simulations, and knowledge-check modules. E-textbooks support flexible navigation, allowing users to move between sections freely. Each section includes theoretical content, examples, exercises, commentaries, and assessments, often in the form of tests. Hypertext links enable easy transitions between sections, while pop-up hints provide additional clarification without cluttering the interface. Furthermore, e-textbooks should be designed with varying difficulty levels to accommodate different learning needs (Honchar et al., 2021).

An electronic learning guide is an electronic publication that either partially or entirely replaces or complements a textbook and has been officially approved in this capacity. It serves as a supplement to traditional textbooks and may cover specific sections of a discipline rather than the full curriculum. Unlike textbooks, learning guides can present not only widely accepted and proven knowledge but also diverse perspectives on particular issues (Hardman, 2008).

Visualisation involves presenting information in a clear, visual format through the use of illustrations, charts, and animations. In physical education classes, for example, visualisation may include motion sequences that demonstrate techniques for specific movements, video clips, or tactical diagrams for team sports. Accompanying text with visuals, including illustrations, diagrams, photos, and motion sequences, can greatly improve comprehension. Computer technologies enhance the impact of visual aids in physical education classes. In digital learning guides, these visuals can be accessed as needed via user-friendly interface elements (Ahsan, 2024).

An electronic presentation is one of the most efficient and accessible methods for delivering information today. Its effectiveness stems from several key technical advantages like clarity, accessibility, compactness, and versatility. These presentations consist of slides on a specific topic and can incorporate a mix of text, hypertext links, graphics, video, and computer animations, all integrated into a cohesive format. They can contain varying types and amounts of content, including images, motion sequences, video clips, and electronic reference materials. A key feature of electronic presentations is their interactivity, which allows users to interact through control elements. The technologies used to create presentations can vary, resulting in different features and styles. For instance, Microsoft PowerPoint is the most widely used platform, offering customizable slide transitions and the ability for text and images to appear either automatically or by mouse click, making it user-friendly. There are also HTML-based presentations, FLASH presentations with multi-level elements, as well as presentations featuring GIF animations.

Electronic presentations provide teachers with a wide range of possibilities for presenting educational materials. They are not limited in how they deliver content, allowing them to fully use visual learning techniques. The advantages of electronic presentations include the structured presentation of large volumes of information, the creation of a comprehensive understanding of a subject, the ability to display multiple images, and the enhancement of the overall engagement of a traditional lesson (Elmi et al., 2024).

Hypertext refers to a specialised text structure that links different text sections. When dealing with extensive information, it is supported by references or footnotes, which can lead to other parts of the text or provide multimedia elements such as photos, audio, or video illustrations that further explain specific content.

Accordingly, hypertext is a text structure that organises information into a system or hierarchy, creating a unified yet diverse network of texts. It highlights the relationships between different sections, making it an effective method for presenting extensive information. Hypertext is built using HTML (Hyper Text Markup Language) software. This technology allows for the creation of links or “paths” that reveal virtual structures. Hypertext software generally features four main functions: substitution, linking, notes, and queries.

The substitution function allows parts of the text to be replaced with images, graphics, or other text elements during viewing. For instance, instead of showing only a section title, one might view the actual content of that section. The linking function facilitates navigation through an information network, enabling exploration of the text at various depths and directions. This navigation can be done via a mouse (in interactive mode) or through queries. The notes function is similar to traditional marginal notes but uses current digital tools such as video files, colour graphics, or audio. The queries function aids in text analysis by allowing data related to specific fragments or keywords to be accessed. In all these instances, relevant information is filtered from the hypertext.

Hypermedia extends the concept of hypertext by integrating multimedia elements. A hypermedia document can include not only hypertext but also graphics, sound, and video. The

advantages of hypermedia systems lie in their ability to create intricate information networks with connections to other information sets.

A social network is a structure comprised of nodes, representing social entities such as individuals or organisations, and the connections between them. Social networks are among the most popular online services today, capturing the vast majority of Internet users' attention. The potential for using social networks in physical education to achieve educational goals is quite underestimated. The intuitive interfaces of social networks facilitate significant time savings by eliminating the need for students to adapt to the latest platforms for communicative interaction (Lytvyn & Soloviov, 2015).

Social media platforms encourage casual interactions between educators and students. They also allow educators to understand students' interests and, therefore, promote personalised education. Within higher education, the most recent advancements in IT are used for the management and self-assessment of knowledge in a variety of disciplines, functional diagnostics, and online education. As noted by Kutsevol (2007), the use of computer-based evaluations provides various advantages, including personalised assessment, increased impartiality, and the capability to visually monitor specific progress and mistakes.

Integrating multimedia and AI in education can greatly enhance student participation and general success. An area that deserves special attention is the quantitative analysis of their effectiveness, conducted through empirical research. This article discusses findings from various studies and pilot projects that reveal the effects of multimedia and AI-enhanced adaptive learning systems on cognitive load, motivation, and educational performance (Ráthonyi et al., 2018).

A study by Pickman (2023) shows that interactive multimedia presentations featuring augmented reality (AR) elements increase student engagement by 35% compared to traditional lectures.

The effectiveness of interactive videos and simulations in science courses was assessed in a pilot project conducted in Malaysian schools. The group using multimedia materials showed an 18% improvement in test results compared to the control group. Additionally, 92% of students reported that visualising complex concepts (such as physical phenomena) helped them better understand the material (Dahlan et al., 2023).

The EdTech Lab study examined the learning outcomes of students using AI-based systems such as Knewton (IE University, 2024). The results showed a 15% average improvement in academic performance among students who used AI-supported systems after completing a six-week course. The system tailored content to individual student needs and automatically flagged topics requiring additional study.

At the University of Valencia, students using AI-powered chatbots for exam preparation reported 28% higher satisfaction with their learning experience than the control group (Sáiz-Manzanares et al., 2023).

Recommendations for implementation include the development of pilot programs that incorporate multimedia and AI to assess the impact of these technologies on the learning process. Additionally, it is suggested to use data analytics to monitor student progress and adapt learning materials accordingly. Furthermore, integrating multimedia and AI tools into core educational programs, particularly in fields that require visualisation or practical application, is essential for enhancing the learning experience.

Empirical evidence indicates that multimedia and AI are effective tools that improve student engagement and academic success. When integrated into the learning process, particularly with a focus on cognitive load principles, these technologies pave the way for personalised, efficient, and measurable learning experiences.

6. Cognitive Engagement through Interactive Technologies and AI-Based Personalised Learning

In today's education, interactive technologies and artificial intelligence (AI) are becoming essential tools for enhancing students' cognitive engagement. These technologies enable adaptive learning programs, personalised approaches, and active interaction with educational content, all of which promote cognitive skills, critical thinking, and learning motivation development.

Interactive technologies create an environment that fosters active learning through platforms with feedback features (such as Kahoot and Mentimeter), which engage students in the learning process. Additionally, simulations and virtual reality tools can create realistic learning scenarios, enabling a deeper understanding of complex topics, such as studying ecosystems through VR.

Integrating gamification into the learning process further boosts motivation and engagement while fostering a competitive atmosphere. AI tailors the learning experience to each student's particular needs, consequently enriching cognitive engagement. By assessing student actions, AI systematically alters learning resources to correspond with the student's comprehension level, learning velocity, and areas of interest, as shown by Coursera and Duolingo. Additionally, it offers tailored suggestions for continued education, fostering a sense of independence (Honchar et al., 2021). AI assistants like ChatGPT help students by responding to their inquiries and developing personalised learning strategies. Chatbots deliver immediate support and enhance access to educational materials.

With the rise of interactive technologies and AI-supported personalised learning, new opportunities appear for promoting cognitive engagement. They provide a more tailored educational journey, stimulate critical thinking, and enhance motivation. However, to maximise their efficiency, it is vital to tackle different challenges. Introducing these technologies to the educational process necessitates a comprehensive approach. It includes specialised training for teachers, stable access to technologies, and a solid legal framework.

7. Conclusions

Thus, the article highlights the relevance of promoting the digital learning concept in today's educational landscape. This reflects the advancement in technology that facilitates the acquisition of educational materials, particularly through remote learning. It effectively illustrates the current movement towards the widespread adoption of the latest media educational technologies across full-time, evening, and distance learning settings. Moreover, it highlights the holistic integration of automated (computer) learning technologies with conventional forms of education. E-learning encompasses the extensive deployment of multimedia and hypermedia, facilitating remote access to distributed educational resources through web technologies. It also emphasises the use of various network tools to foster interaction among students and between students and teachers.

The article defines the concept of using e-learning platforms and software in physical education pedagogy to enhance teaching excellence. It proves that an effective e-learning platform for physical education should incorporate diverse curricula, integrating multimedia elements such as 2D/3D animation and digital video into the educational process. A key objective of using e-learning and software in this context is to focus on preparing fundamental cinematic movements, allowing the instruction of sports skills through videos demonstrating these core kinematic movements.

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