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Measuring the Proficiency of Physical Education Teachers in Utilizing Information and Communication Technology for Virtual Classes

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A B S T R A C T

Technology is advancing at an astonishing pace, and this wave of innovations has opened a new window to the world of education. In this world, online classes have replaced the conventional classroom setting, eliminating concerns such as exorbitant costs, time-consuming transportation, and environmental challenges. As a result, virtual education has become a desirable option. Based on this, the aim of this research was to assess the proficiency of physical education teachers in utilizing information and communication technology in virtual classes. The current research employs a descriptive quantitative approach. The statistical population of the research included full-time faculty members and visiting professors from the sports science faculties of Tehran universities (Tehran, Kharazmi, Al-Zahra, Shahid Beheshti, and Allameh Tabatabai universities). A statistical sample of 97 individuals was selected based on Morgan's table. To collect research data, a researcher-designed questionnaire was utilized. The questionnaire was prepared by utilizing library resources and was constructed around a five-point Likert scale. The content validity of the questionnaire was verified by 10 university professors. Additionally, the questionnaire's reliability was determined through the calculation of Cronbach's alpha coefficient, which yielded a value of 0.93. The research results indicate that enhancing the information technology abilities of physical education professors can greatly support both in-person and online education. It is recommended that heads of faculties and faculty members take the initiative in adopting and utilizing this technology across different educational contexts, considering its ongoing advancements.

Keywords: *Virtual education, Physical education colleges, FAVA, Technology*

1. Introduction

In the early 1970s, the invention of the first modern computer prototypes marked the beginning of a major transformation in people's daily lives. However, it was not until the late 1990s that the digital technology sector experienced rapid and widespread growth (Ameri, 2011). Currently, more than 50% of organizational expenditures in the United States are allocated to the acquisition of technological products (Gökalp, 2011). As a result, companies have increasingly focused on expanding their presence in this field, resulting in intense competition to secure greater market share (Lashkarara F, 2019). The expansion of digital technologies has undoubtedly influenced all dimensions of human life. A strong focus on information and communication technology (ICT) has significantly contributed to improving quality of life. In fact, it is considered one of the three most influential

technologies of the 21st century (Qinfei, 2010). As technology becomes increasingly embedded in educational environments, educators and researchers alike are seeking effective ways to integrate it meaningfully into teaching and learning processes (Mim & Kalam Azad, 2024). This is particularly important in ensuring that digital tools are not used in isolation but are combined with sound pedagogical methods and deep content understanding.

In this context, the Technological Pedagogical Content Knowledge (TPACK) framework offers a comprehensive lens through which to examine the complex interplay between technology, pedagogy, and subject matter expertise. Developed by Mishra and Koehler (2006), TPACK provides a structured model for understanding how teachers can thoughtfully incorporate technology into their instructional practice. It emphasizes three core domains—Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK)—as well as the intersections among them (TPK, TCK, PCK), culminating in the fully integrated domain of TPACK (Mishra & Koehler, 2006). Building upon frameworks like TPACK, the growing shift toward digital learning environments has been significantly influenced by broader technological advancements, especially in response to global challenges and educational demands.

In recent decades, a new form of education known as electronic education and virtual education has emerged in response to educational needs (Gupta et al., 2024; Mehall, 2020). This development has positioned the power of educational technology on the cusp of a significant revolution, transforming the intellectual model of education, and introducing innovative teaching and learning methods. Meanwhile, artificial intelligence plays a prominent role in accelerating this revolution through its capabilities, including deep learning algorithms, natural language processing, and visual perception (karimi, 2021; Zhao, 2023). With the onset of the Covid-19 virus epidemic in December 2019 and the declaration of a state of emergency by the World Health Organization (Millán-Oñate, 2020), higher education centers were mandated to suspend their activities. As a result, classes, exams, and workshops were conducted virtually. It appears that the implementation of these measures heightened the necessity and significance of advancing and expanding virtual and electronic education, capturing widespread attention (Faghir Ganji et al., 2024). A virtual classroom is an online learning environment characterized by terms like web-based learning, distance learning, network-based learning, and e-learning. In this setting, teachers have the ability to deliver audio and video content as well as share digital media with students (Chowdhury, 2020; Omar et al., 2024), which can greatly influence individuals' academic advancement and efficiency (Sahraneshin 2015). In general, both before and during the pandemic, there has been a growing body of research on virtual physical education classes at the university level (Baticulon et al., 2021; Griffiths et al., 2022; Rayner & Webb, 2021). However, while previous research highlights the impact of information and communication technology on enhancing the quality of teaching and learning (Hosseini Farhangi, 2007; Reddy & Reddy, 2022), there is limited evidence regarding the utilization of these technologies and their effectiveness in optimizing student learning (Armour et al., 2016). Therefore, proficiency in this area is vital and regarded as one of the pillars of power in the modern era.

Currently, technology has permeated the classroom, revolutionizing teaching and learning. In the realm of physical education, the incorporation of information and communication technology is crucial. Teachers should employ these tools with contemporary methodologies, adhering to international standards (Msambwa et al., 2024; Stanescu, 2011). The results provided by Yousefi and her colleagues (2023) highlight the significant impact of principled and appropriate utilization of modern technologies, as well as the consideration of effective factors, in fostering the development of public sports through diverse means (Yousefi et al., 2024).Additionally, Jalilund and his colleagues (2023), in their research titled "Presenting a knowledge management model based on information technology in physical education in Iran," demonstrate the importance of allocating resources towards enhancing information and communication technologies, as well as developing infrastructure for management information systems in the field of physical education and education. The overarching objective is to enhance knowledge management. Furthermore, they emphasize the need for strategic planning to empower physical training and improve technological skills (Jalilund et al., 2023).

In previous research, it has been observed that the utilization of new technologies in classroom management not only enhances interaction and communication between professors and students, but also contributes to increased academic motivation (herlinawati Yeni & Rindaningsih, 2024), as well as improved satisfaction with the quality of education and the learning process (Huang et al., 2023). In most fields of physical education and sports sciences,

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including kinesiology, pathology, and others, there is a strong demand for information and communication technology to effectively convey information to learners. In this regard, professors need to enhance their knowledge, skills, and self-efficacy in utilizing technology to strengthen information and communication (Papastergiou, 2010). It should be recognized that this technology can be effectively utilized in organizing high-level sports events and facilitating various sports activities. It has brought about a significant transformation in this field. Additionally, it greatly impacts not only the performance and motivation of athletes but also the judges' ability to draw accurate conclusions and make informed judgments (Karimi N, 2015). This technology can enhance the amount of visual, auditory, and movement information in all areas of physical education (Stanescu, 2009). Although research on the use of information and communication technology in physical education has been limited, there is no doubt that the spread of Covid-19 and the resulting changes in the country's education system have brought virtual education to the forefront. Given these changes, particularly in view of emergency situations such as air pollution or unfavorable weather conditions, there is an essential need for new data and insights regarding the application of existing technologies. Therefore, the present research assesses the proficiency of physical education teachers in utilizing information technology during virtual classes. The resulting findings may prove valuable to faculty members and department heads of physical education faculties, facilitating the enhancement of professors' competency in information and communication technology within this domain.

2. Methods and Materials

The current research paradigm is descriptive, employing a quantitative approach. Based on its purpose, it falls under the category of applied research, and the data has been collected through a survey. The statistical population of the research comprised all full-time faculty members and visiting professors from the sports science faculties of Tehran universities (including Tehran, Kharazmi, Al-Zahra, Shahid Beheshti, and Allameh Tabatabai universities). A statistical sample of 97 individuals was selected using Morgan's table. After the questionnaires were completed, they were entered into the software for analysis.

To collect research data, a researcher-designed questionnaire was utilized. The questionnaire consisted of 36 items organized into 7 components aligned with the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006). These components included the skill requirements for using Adobe Connect and LMS programs (items 1 to 7), the skill requirements for using the Skyroom program (items 8 to 11), the preliminary knowledge requirements for professors in using information and communication technology (items 12 to 15), the preliminary skill requirements for professors in using this technology (items 16 to 22), the knowledge requirements for utilizing this technology in designing and developing physical education curricula (items 23 to 29), the skill requirements for employing information and communication technology in curriculum implementation and teaching (items 30 to 32), and the knowledge requirements for evaluating curriculum and students' academic progress using this technology (items 33 to 36). Adobe Connect is an internationally recognized platform used for virtual classrooms, enabling real-time video conferencing, screen sharing, and collaborative tools. Skyroom, in contrast, is a locally developed Iranian e-learning platform widely adopted by universities in Iran for delivering synchronous online instruction in Persian. The questionnaire was developed using library resources and was rated on a five-point Likert scale. It is worth noting that the content validity of the aforementioned questionnaire was confirmed by 10 university professors. The questionnaire's reliability was assessed using Cronbach's alpha coefficient, resulting in a value of 0.93. Additionally, exploratory and confirmatory factor analysis were employed during the first and second stages to validate the structure of the questionnaire.

Finally, for the analysis of the research data, descriptive and inferential statistics were utilized. Additionally, path analysis method and structural equation tests were employed to establish the statistical model of the research in standard and significant modes. In this study, data analysis was conducted using SPSS 22 and Lisrel 8.8 software programs.

3. Findings and Results

Firstly, the demographic characteristics of the sample under study are presented in Table 1.

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Table 1

Demographic characteristics

Variable	Domain	Frequency
Gender	Man	52
	Female	46
Age	22 to 33 years old	10
	34 to 44 years	43
	45 to 55 years	26
	Over 55 years old	18
Marital status	Single	23
	Married	74
Type of employment	Contractual	53
	Treaty	9
	Official trial	8
	Definitely official	27
Field of Study	Management	40
	Physiology	23
	Movement behavior	30
	Pathology and corrective movements	2
	Psychology	2

As shown in Table 1, the highest frequency is attributed to men's choice (52.6), while the lowest frequency is attributed to women's choice (47.4). Based on age, the highest frequency is associated with the option of 34 to 44 years (44.3), while the lowest frequency is associated with the option of 22 to 33 years (10.3). Based on marital status, the highest frequency is associated with the married option (76.3), while the lowest frequency is associated with the single option (23.7). Based on the type of employment, the highest frequency is associated with the contractual option (54.6), while the lowest frequency is associated with the official trial option (2.8).

Finally, based on the field of study, the highest frequency is associated with the field of sports management (2 out of 41), while the lowest frequency is associated with the fields of pathology, corrective movements, and sports psychology (1 out of 2). After examining the demographic characteristics, the data distribution was investigated for normality using skewness and kurtosis tests. Based on the results, it was determined that the research data followed a normal distribution, allowing for the use of further parametric tests. Factors were identified and investigated through the use of exploratory factor analysis.

In this analysis, using the principal component analysis method and the values of more than seven factors: the skill components needed to use Adobe Connect and LMS programs, the skill components needed to use the Skyroom program, the preliminary knowledge components of professors to use information technology and Communication, the preliminary skill components of professors to use information and communication technology, the knowledge components required to use information and communication technology in the design and development of physical education curricula, the skill components required to use information and communication technology in the implementation of the curriculum and teaching components The knowledge required for the use of information and communication technology in the evaluation of the curriculum and academic progress of students were determined and approved. Table 3 reveals that all question factor loadings exceed the base value (0.40). Additionally, referring to Table 2, the obtained chi-square statistic for this model was 2430.163. The dimensions of the model support this result, indicating that the assessment tool for measuring the proficiency of physical education professors in utilizing information and communication technology in virtual classes possesses a multidimensional structure. To establish the saturation of this questionnaire with multiple significant factors, two primary indicators were considered: 1. Eigenvalues, and 2. The proportion of variance explained by each factor. It is worth noting that the seven factors collectively account for 65.93% of the variance in the measurement tool, elucidating the proficiency of physical education professors in utilizing information technology and highlighting the multidimensional nature of tools in sports.

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Table 2

Bartlett and KMO test results

Index		Value
KMO values (adequacy of sample size)		0.730
Bartlett's sphericity test	Chi-square statistic value	163.2430
	Degrees of freedom	630
	level of significance	0.001

The Bartlett's test of sphericity, KMO test, functions as an indicator of sample adequacy. This test allows for the assessment of the level to which variables are associated with each other (i.e., causal causality) and, consequently, their appropriateness for factor analysis. Moreover, it enables the evaluation of the suitability of each individual variable on its own. The value for Bartlett's sphericity test is determined to be 0.730, indicating a favorable outcome. This test examines the assumption of correlation between questions. Based on the chi-square value and the significance level ($P<0.001$, $X2=2430.163$), it can be concluded that there is a correlation between the questions. Therefore, it is permissible to proceed and utilize other stages of factor analysis.

Table 3

The results of the variance contribution of each of the factors in the 7-factor model

Factor	Total variance	Percentage of variance	Cumulative variance percentage
Factor 1	4.67	13.23	13.23
Factor 2	4.56	12.67	25.90
Factor 3	3.91	10.86	36.76
Factor 4	3.37	9.37	46.14
Factor 5	3.16	8.77	54.91
Factor 6	2.41	6.70	61.62
Factor 7	1.55	4.31	65.93

Table 3 displays the specific values, variance of the factors, and their cumulative variance percentage. The total variance of the seven factors indicates that the predictive power of this model is 65.93%. Additionally, the results of factor analysis in this research indicate that the items of the tool for measuring the ability of physical education teachers to use information and communication technology in virtual classes account for 93.65% of the total variance. The variance percentages for factor 1 are 23.13, for factor 2 are 67.12, for factor 3 are 86.10, for factor 4 are 37.9, for factor 5 are 77.8, for factor 6 are 70.6, and for factor 7 are 31.4. The results of the factor loading of the questions indicate that all the questions have acceptable factor loadings. After identifying the factor loadings of the questionnaire items through the first stage of confirmatory factor analysis, the validity of the questionnaire used was examined. The values of the RMSEA, IFI, NFI, and CFI indices were 0.79, 0.95, 0.92, and 0.90, respectively, confirming the suitability of the tool (see Table 4). To evaluate the model fit, various indices were used, including the chi-square ratio to degrees of freedom (χ^2/df), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Non-Normed Fit Index (NFI), and Root Mean Square Error of Approximation (RMSEA). The values of χ^2/df less than 3, CFI, IFI, and NFI exceeding 0.90, and RMSEA of 0.079 indicate an acceptable model fit (Hu & Bentler, 1999). Therefore, the tool assessing the proficiency of physical education instructors in utilizing information and communication technology within virtual classrooms is deemed valid.

Table 4

Tests and indicators of the tool model for measuring the ability of physical education professors in using information technology in virtual classes

Model	RMSEA	IFI	NFI	CFI	X2 .df	P-Value
A tool for measuring the ability of physical education teachers in using information technology in virtual classes	0.079	0.95	0.92	0.90	2.20	0.001

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Figure 1

Confirmatory factor analysis of the tool for measuring the ability of physical education professors in using information technology in virtual classes in standard mode

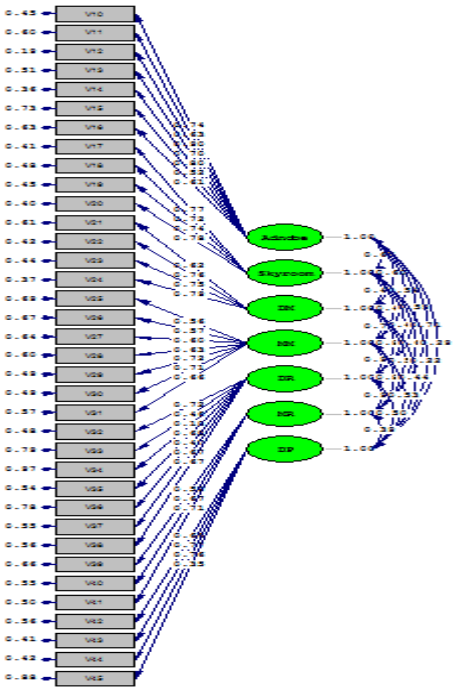
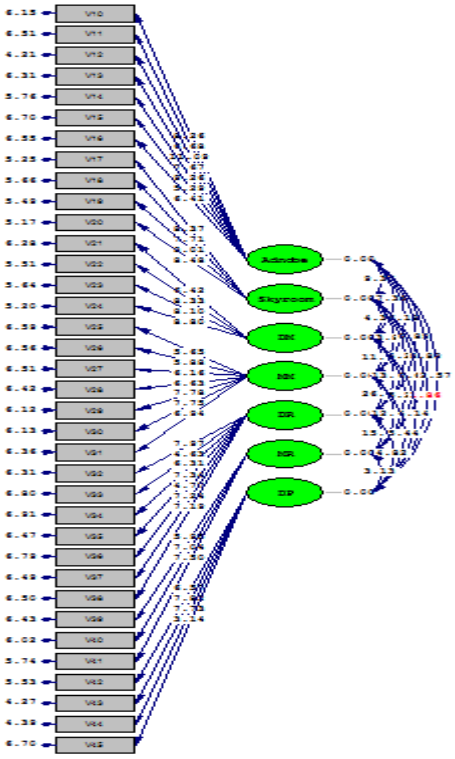


Figure 2

Confirmatory factor analysis of the tool for measuring the ability of physical education professors in using information technology in virtual classes in a meaningful way



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In order to evaluate the proficiency of physical education professors in utilizing information and communication technology in virtual classes, a T-Tech test was administered as a sample. This test compared the mean score of each component with the benchmark score, which was determined based on the 5-point scale of the questionnaire (i.e., 3). The results of this analysis are presented in Table 5, providing insights into the measurement of their abilities.

Table 5

A sample T-Tech exam to determine the role of the questionnaire score for measuring the ability of physical education professors in using information technology in virtual classes.

Variable	mean	t statistic	P-Value
Skill components required to use Adobe Connect and LMS programs	3.49	5.33	0.001
Skill components required to use the Skyroom program	3.11	1.21	0.022
Preparatory knowledge components of professors to use information and communication technology	3.41	4.56	0.001
Preparatory skill components for professors to use information and communication technology	3.65	8.25	0.001
Knowledge components required for the use of information and communication technology in the design and development of physical education curricula.	3.40	5.57	0.001
Skill components required for using information and communication technology in the implementation of curriculum and teaching	3.39	4.43	0.001
The knowledge components required for the use of information and communication technology in the evaluation of the curriculum and academic progress of students	3.57	7.37	0.001

In Table 5, it can be observed that the median score for the proficiency of physical education professors in utilizing information technology and its various components indicates a relatively positive situation. The median score exceeded 3, suggesting a favorable level of proficiency. Additionally, based on the significance levels, it was found that the proficiency of professors and all its components, except for the skill components required to use the Skyroom program, had a significance level less than 0.01. Therefore, it can be concluded that the proficiency of physical education professors in using information technology and these components lies between the intermediate range. There is a significant difference from the hypothetical average, except for the median score of the skill components required to use the Skyroom program, where no significant difference was found in comparison to the hypothetical median. Moving forward, the verification model of the research's second stage will be presented in two modes: standard and significant.

Figure 3

Confirmatory factor analysis of the second stage of the tool for measuring the ability of physical education professors in using information technology in virtual classes in standard mode

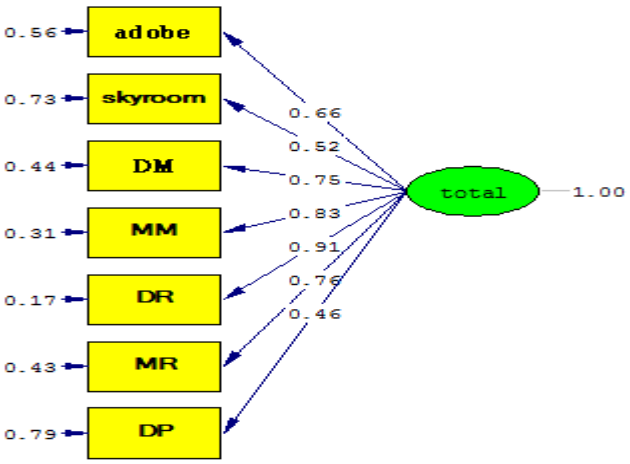

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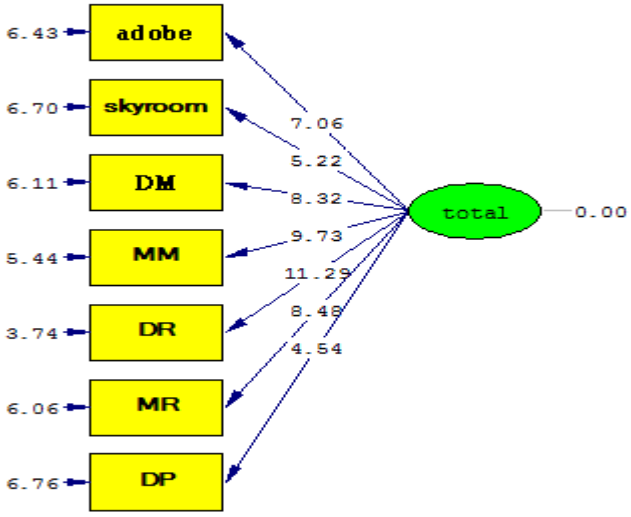
Figure 4

Confirmatory factor analysis of the second stage of the tool for measuring the ability of physical education teachers in using information technology in virtual classes in a meaningful way



The results of the second-stage confirmatory factor analysis indicate that the values of RMSEA (0.076), CFI (0.95), NFI (0.92), and IFI (0.95) demonstrate an acceptable model fit (Hu & Bentler, 1999). These values confirm the suitability and adequacy of the research tool.

Table 6

Tests and indicators of the tool model for measuring the ability of physical education professors in using information technology in virtual classes

Model	RMSEA	IFI	NFI	CFI	X2 .df	P-Value
A tool for measuring the ability of physical education teachers in using information technology in virtual classes	0.079	0.95	0.92	0.95	2.34	0.001

4. Discussion and Conclusion

Information and communication technology (ICT) plays a vital role in advancing educational objectives, particularly by facilitating access to resources and enhancing learning efficiency. This study examined the ICT proficiency of physical education professors in virtual classrooms. The findings indicate that foundational ICT competencies—such as the use of basic software, file management, email, and internet navigation—received the highest average score among all components (M = 3.65), suggesting a satisfactory level of digital literacy among physical education professors. This reflects the widespread adoption of general digital tools in academic settings and supports the notion that basic technological knowledge (TK), as outlined in the TPACK framework (Mishra & Koehler, 2006), is becoming increasingly embedded in educators' professional routines. However, a notable weakness was observed in professors' ability to configure peripheral devices (e.g., printers and scanners), with a factor loading of 0.47. This suggests that while general ICT usage is prevalent, practical technical troubleshooting remains underdeveloped, possibly due to lack of training or institutional support (Salimi et al., 2018; Zahra et al., 2017).

The second highest scoring variable pertains to the knowledge required for applying ICT in the evaluation of curricula and student academic performance (M = 3.57). This component yielded the highest factor loading among all variables (0.83), indicating its strong influence on the overall proficiency construct. The increasing reliance on virtual learning management systems, messaging platforms, and digital assessments during and after the pandemic may have contributed to this trend. Yet, within this domain, the lowest-performing sub-component was professors' familiarity with email software for maintaining

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communication and feedback loops with students (loading = 0.54). This gap suggests a superficial engagement with communication tools, which undermines the potential of ICT to support formative assessment and continuous feedback—critical components of effective virtual instruction. These findings partially diverge from earlier studies (Saraji et al., 2014), which reported more widespread challenges in applying ICT for assessment. However, consistent with Abbasi et al. (2018) and Asghari et al. (2012), our results reinforce ongoing concerns regarding the lack of standardized protocols for electronic evaluation, insufficient training in technology-based assessment, and limited confidence in the validity of digital assessment tools (Abbasi et al., 2018; Asghari et al., 2012). Therefore, faculty development programs must prioritize the pedagogical integration of ICT in assessment practices, ensuring that professors not only use digital tools but do so in ways that are pedagogically sound and aligned with educational goals.

Another component with a relatively high mean score is the skill required to operate Adobe Connect and LMS platforms (M = 3.49), with the highest factor loading observed for the ability to install and run these programs (loading = 0.82).This reflects the increasing institutional dependency on virtual education tools, particularly during the COVID-19 pandemic. The forced transition to remote teaching prompted educators to rapidly acquire platform-specific operational skills, transforming digital infrastructure into a cornerstone of instructional delivery.(Jalalabadi & Mohaghegzadeh, 2023). From the lens of the TPACK framework, this trend suggests a strengthening of technological knowledge (TK), yet it does not necessarily indicate integration with pedagogical or content knowledge. However, the lowest-performing element within this skill set—namely, using conference functions and file-sharing features (loading = 0.46)—signals a gap in applying these platforms to facilitate interactive learning. This aligns with the broader concern that many educators, while technically capable of launching digital tools, lack the pedagogical fluency to use them meaningfully for engagement and communication (Jalalabadi & Mohaghegzadeh, 2023). Therefore, professional development efforts should extend beyond basic operations and emphasize pedagogical use of virtual tools for student-centered learning (Papastergiou, 2010; Schmidt & Karintholil, 2025).

The next variable examined was the preliminary knowledge of professors regarding information and communication technology, which received a moderate average score (M = 3.41). Within this domain, the most prominent component was the ability to use software tools and conduct effective online searches (loading = 0.77), likely reflecting the general ubiquity of internet access and the integration of digital tools in academic workflows (Vakilimofrad, 2005). As digital literacy becomes a prerequisite for research, publication, and academic networking, such competencies are increasingly embedded in academic culture. Nonetheless, this does not guarantee comprehensive digital competence. The reliance on generic search and browsing skills may not translate into more advanced ICT integration unless accompanied by structured training. These findings reinforce the notion that job-related exposure alone is insufficient for building robust digital capacity (Abbasi et al., 2018; Salimi et al., 2018; Yanping & Weiye, 2025). As such, institutional strategies should focus on bridging the gap between general digital awareness and contextual ICT expertise, particularly in the field of physical education where applied, visual, and interactive tools can dramatically enhance learning outcomes. The widespread adoption of the Internet has significantly influenced the academic practices of faculty members. A study conducted at Hamadan University of Medical Sciences reported that 94.9% of faculty members regularly used the Internet (Vakilimofrad, 2005) Given technological advancements, this figure has likely reached a very high level today. The findings of the present study also indicate that physical education professors possess a moderate level of knowledge in information and communication technology (ICT), particularly in software use and web-based search. However, the lowest factor loading in this domain (0.53) pertains to professors' understanding of Internet-related terminology and functions. This suggests that while professors actively use digital tools, their conceptual and technical understanding remains limited. Addressing this gap requires targeted instructional strategies, such as simulation-based learning, structured training programs for application software, subsidized education, and performance-based ICT assessments. These methods can enhance professors' technical and conceptual knowledge.

In the domain of designing and developing physical education curricula, professors' ICT knowledge was assessed with an average score of 3.40. Professors demonstrated outstanding capabilities in using design software, such as Adobe Photoshop and Paint, and employing visual media (e.g., images, posters, and videos)

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to support pedagogical objectives. The factor loading of 0.67 confirms these skills as a notable strength, particularly in physical education, where visual and spatial tools play a critical role in knowledge transfer. These technical skills, particularly in the use of design software and educational media, are increasingly vital for effective teaching in face-to-face, online, and hybrid formats. However, to have a deeper impact on curriculum innovation, these skills must be integrated within broader pedagogical frameworks, such as the TPACK framework (Mishra & Koehler, 2006). This framework emphasizes the importance of combining technological knowledge (TK), content knowledge (CK), and pedagogical knowledge (PK) to ensure that digital tool use leads to deep learning outcomes. Without such integration, even advanced tool proficiency may not fully contribute to improving educational quality. Using shapes and images related to the topic while teaching can greatly enhance the ease of learning the lesson. Additionally, this technology has the ability to improve information retention in people's minds, thanks to the implementation of innovative educational methods (Farajollahi M, 2009); These findings align with previous research emphasizing the role of educational images and videos in enhancing learning processes (Nili M, 2016). Additionally, the utilization of browser software, one of the variables, demonstrated the lowest contribution with a factor load of 0.45. It is advisable for professors to enhance their skills in this area, as this program proves highly beneficial in obtaining and carrying out statistical analyses, similar to the role of SPSS in certain research studies. Additionally, Mir Hosseini et al. evaluated the impact of skills training on employee performance in Shahrood University of Medical Sciences (Mir Hosseini et al., 2014). This study is also in line with the topic.

The skill related to the implementation of curriculum and instruction using information and communication technology received a mean score of 3.40. This domain encompasses a range of competencies, including the use of television broadcasts, educational films, and multimedia software to enrich classroom instruction. Additionally, professors demonstrated the ability to develop and present content through platforms such as PowerPoint, as well as to record and assess student progress using digital tools like Word, Excel, and Access. Despite these capabilities, the findings suggest that many faculty members still rely on traditional, manual grading methods, limiting their ability to benefit from automated assessment features. Familiarity with data processing tools not only enhances administrative efficiency but also supports timely feedback and data-informed pedagogy. These results are consistent with prior studies emphasizing the transformative potential of ICT in the teaching–learning process (Maliki et al., 2019).

The final variable assessed was the skill required to operate Skyroom, a locally developed virtual platform. Unlike other dimensions, this component did not yield a statistically significant difference from the average, suggesting a general unfamiliarity with Skyroom's functionalities. This is likely due to the widespread preference for Adobe Connect in Iranian universities, especially during the pandemic. Nevertheless, the growth of e-learning during the COVID-19 crisis—despite infrastructural and pedagogical limitations—revealed clear benefits. The institutionalization of digital tools and platforms created a resilient educational structure capable of functioning during disruptions such as air pollution, extreme weather, or natural disasters. Virtual education thus emerges as a strategic alternative that can complement traditional classroom-based approaches.

In light of these findings, the development of ICT-related skills among physical education faculty should be viewed as a priority. To that end, institutions are encouraged to design comprehensive capacity-building initiatives. These may include in-service training programs, pedagogical workshops, collaboration with software developers, and investment in digital infrastructure. Furthermore, the presence of ICT consultants or support teams can enhance the usability and pedagogical integration of such technologies in physical education contexts. Overall, the study highlights a complex digital landscape among physical education professors—characterized by moderate proficiency in general ICT tools, stronger performance in specific software usage, and gaps in interactive or pedagogically integrated application. These patterns underscore the importance of designing ICT training programs that are not only technically robust but also pedagogically aligned, in order to foster sustainable digital teaching practices.

This study has two primary limitations. First, it relies exclusively on self-reported data, which may be influenced by personal bias or overestimation and may not accurately reflect actual digital competencies. Although self-assessment tools are valuable, future research should incorporate performance-based assessments or observational methods to validate and triangulate these findings. Second, the geographic scope of this research is limited to physical education faculties in Tehran-based

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universities. While these institutions represent leading academic centers in Iran, regional differences in ICT infrastructure, educational policies, and access to digital resources may affect the generalizability of the findings. Expanding the sample to include universities from other provinces would enhance the external validity and broader applicability of future studies.

The research results indicate that enhancing the information technology abilities of physical education professors can greatly support both in-person and online education. It is recommended that heads of faculties and faculty members take the initiative in adopting and utilizing this technology across different educational contexts, considering its ongoing advancements.

Authors' Contributions

Authors equally contribute to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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