

# Technological Competencies of Physical Education Teachers in the Digital Era

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## Abstract

In response to worldwide moves toward digital education, this cross-sectional study looks at the technological competencies of physical education teachers in Palestine—a setting where such research is still rare. Data were obtained from 55 physical education instructors in the Ramallah Governorate using a validated, high-reliability questionnaire (Cronbach's alpha > 0.91). Three areas—technological literacy and usage, educational technology applications, and e-learning competencies—were evaluated in this paper. The results demonstrate a high level of technological competency, with no significant differences based on gender, school type, or years of experience. Lower proficiency was observed, nevertheless, in using modern technologies such virtual reality and collaborative learning environments. This study underlines the need of focused professional development to close gaps in advanced technology use and adds new perspectives on the digital readiness of physical education teachers in under-resourced environments. The results guide curriculum designers and policy-makers on areas needing assistance in programs for teacher preparation.

## 1. Introduction

Technological competence is defined as "the ability to critically analyze information through personal, autonomous, and collaborative efforts, and to effectively utilize technological resources to address real-world challenges (Níkleva & López Ogáyar, 2012). Berrocoso and Díaz (2015) distinguished the integration of Information and Communication Technologies (ICTs) into three levels; (i) substitution level which is the initial level and means supplying schools with technological infrastructure, (ii) augmentation level which is the intermediate level and in this level teachers integrate online resources and engage more in digital skills, to improve the quality of education (iii) transformation level; the highest level in which complete incorporation of ICTs raise to enhance knowledge production and online collaboration (Correa et al., 2015; Revuelta-Domínguez et al., 2022). Each level represents a different level of technological proficiency, from first exposure to complete integration as an educational tool.

Teaching Competence (TC), which refers to the ability to effectively integrate digital tools into the curriculum, is now a critical requirement for educators in the new teaching process (Revuelta-Domínguez et al., 2022). The quick development of digital technology has significantly changed the nature of education, forcing teachers to adopt new approaches that apply technology into the learning process. Technology advancements in physical education provide innovative opportunities to improve instruction through video analysis, wearable devices,

virtual reality, and interactive platforms. The integration of digital tools does not only enhance learning outcomes and student engagement, but it also helps teachers acquire critical technological skills (Al-Surur, 2018).

While global developments highlight the growing importance of digital competence in education, their implementation and impact vary widely depending on local context. As a developing country, Palestine faces unique challenges in integrating digital technology into its educational system. For instance, 3rd Generation (3G) services were not introduced in the West Bank until 2018, and since then, the ICT industry has made significant progress. In 2023, it was found that about one third of Palestinian households own a computer device (*West Bank and Gaza - Information and Communication Technology (ICT)*, 2023). Palestinian teachers frequently face obstacles like restricted access to technology infrastructure, inadequate training, and financial limitations, even in the face of the global trend toward digital transformation in education. The sociopolitical environment, which influences resource availability and digital education priorities, exacerbates these difficulties (Y. Sehweil, 2021).

According to a recent study on the adoption of technology by Palestinian teachers during the COVID-19 pandemic, there are still large gaps in their capacity to successfully integrate digital tools into their lesson plans, even though many educators showed a positive attitude toward doing so. According to the study, perceived usefulness, ease of use, and the availability of technical support all had an impact on teachers' adoption of technology. Notwithstanding these obstacles, the pandemic hastened the adoption of digital tools, underscoring the potential of technology to improve instruction in settings with limited resources, it concluded that Palestinian teachers are capable of self-learning to build a professional community, and provide a solid basis for the educational system's digital transformation (Y. Sehweil, 2021).

Many studies world-wide have been conducted on the use of digital tools in physical education, confirming the benefits of digital integration in physical education, including improved student motivation, engagement, and performance (Timotheou et al., 2022). A meta-analysis by Sun et al. (2019) found that digital interventions contribute to raising students' levels of activity and physical fitness (Sun, 2019). Nevertheless, a significant portion of the current work emphasizes well-resourced educational contexts, hence creating a deficiency in comprehending the development of digital capabilities in low-resource or conflict-affected countries such as Palestine.

This study aims to address that gap by examining Palestinian physical education teachers' technological competencies and to examine the differences according to gender, school type, and years of experience. By identifying current strengths and challenges, we aim to inform the development of targeted training programs to improve the effective use of technology in physical education. Therefore, the central research question guiding this study is: What is the level of technological competence among Palestinian physical education teachers, and how does it vary based on gender, school type, and teaching experience?

## 2. Methodology

### 2.1 Study Design and Sample

This is a cross-sectional study. We used convenience sampling method of 55 physical education teachers (38 male, 17 female) from schools in the Ramallah Governorate. This approach was chosen due to logistical constraints, including access limitations and time-sensitive data collection during the academic year. Ramallah governorate was selected because it is a central administrative and educational hub in Palestine, making it a practical starting point for examining broader trends. Inclusion criteria required any physical education teacher residing in Palestine, and willing to participate. No exclusions were made based on gender, years of experience or type of school, to ensure a diverse sample. Consents were obtained from all participants prior to data gathering.

While convenience sample may add selection bias and restrict the generalizability of results, we endeavored to alleviate this by include all eligible physical education instructors within the governorate. Moreover, considering that Ramallah is a significant urban center with educators familiar with national curricula, training requirements, and educational policies, the sample may represent wider trends relevant to other metropolitan areas in Palestine.

### 2.2 Materials

A technological competencies questionnaire was developed and inspired by previous research by (Al-Jalama, 2023; Zaki, 2022). The instrument included two sections: the first section included demographic variables such as gender, school type, and years of experience. The second section contained 45 items distributed across three domains, with 15 items in each domain: Technological literacy and usage, competencies in educational technology applications, E-learning competencies, designed in Likert scale (Strongly agree, agree, neutral, disagree, strongly disagree).

## 2.3 Validity and Reliability

The reliability of the study instrument was assessed by calculating the overall reliability coefficient for the study domains using Cronbach's alpha formula. The reliability values ranged between 0.910 and 0.973, indicating a high level of reliability. Content validity was evaluated by four educational experts. This confirms that the instrument is highly stable and suitable for achieving the study objectives.

## 2.4 Data Analysis

SPSS version 22 was used for data analysis. The analysis was thorough and trustworthy, with no missing values. Frequencies and percentages were used to summarize categorical data. Independent sample t-test and one way ANOVA were also used to better understand the relationships between variables. Reliable results were ensured by determining statistical significance at  $p < 0.05$ .

## 3. Results

### 3.1 General Technological Competency Levels

The means and standard deviations of the study sample's answers about the general technological proficiency of physical education teachers are shown in Table (1). Palestinian physical education teachers have reported high levels of technological competency, as evidenced by the mean for the overall competency level, with an overall score of 76.23%. The following were the results across the 3 domains: Technological literacy: 77.92%, Educational technology applications: 76.65%, E-learning competencies: 74.11%.

**Table 1** Arithmetic means, standard deviations, and percentage of responses of the study sample on the level of technological competencies for Palestinian physical education teachers

Domain	Mean	Standard deviation	Percentage (%)
Technological Literacy and usage	3.90	0.588	77.92
Competencies in Educational Technology Applications	3.83	0.647	76.65
Competencies in E-Learning	3.71	0.669	74.11
Overall Score	3.81	0.584	76.23

It can be observed from the previous tables that the highest mean scores for the items are as follows:

The results indicate that the item with the highest mean score was "Educational technology provides me with educational experiences", which recorded a mean of 4.36 (SD = 0.754) and a percentage of 87.27%, reflecting a strong level of agreement among participants. This was followed by the item "Educational technology plays an important role in developing the motor skill conceptualization", with a mean of 4.25 (SD = 0.726) and a percentage of 85.09%, also falling within the "Strongly Agree" range. The third highest-rated item was "I benefit from search engines to enrich information about physical education", which scored a mean of 4.07 (SD = 0.716) and a percentage of 81.45%, indicating general agreement.

Conversely, the item with the lowest mean score was "I can design collaborative learning activities through electronic platforms", which received a mean of 3.47 (SD = 0.940) and a percentage of 69.45%. This was closely followed by "I use virtual reality technology in teaching certain motor skills", with a mean of 3.51 (SD = 0.879) and a percentage of 70.18%, and "I can set up and remove Office software packages", with a mean of 3.55 (SD = 0.878) and a percentage of 70.91%.

### 3.2 Differences Due on Demographic Characteristics

Independent variables were tested by calculating the mean scores, standard deviations, and conducting a t-test to compare the responses of the study sample on technological competencies based on gender. The results are presented in Table 2.

There were no statistically significant differences in technological competency levels between male and female teachers, according to a t-test analysis ( $p > 0.05$ ). Regarding technological proficiency, there were also no significant differences between teachers in public and private schools ( $p > 0.05$ ) and no statistically significant

differences in teachers' technological competencies due on the years of experience ( $p > 0.05$ ), are shown in Table (2&3).

**Table 2** Mean scores, standard deviations, and t-test for independent samples on the responses of the study sample regarding technological competencies of physical education teachers in Palestine based on gender, school type

Domain	Gender	Mean & S.D	t-Value	Sig	School Type	Mean & S.D	t-Value	Sig
Technology Culture and Use	Male	3.83 .570	-1.234	0.222	Government	3.86 606	-0.959	0.342
	Female	4.03 .613			Private	4.08 .454		
Technology Application Competencies	Male	3.81 .680	-0.396	0.693	Government	3.82 .662	-0.355	0.724
	Female	3.88 .593			Private	3.91 .580		
E-Learning Competencies	Male	3.68 .653	-0.391	0.698	Government	3.65 .690	-1.437	0.157
	Female	3.75 .715			Private	4.02 .448		
Total Score	Male	3.77 .591	-0.706	0.483	Government	3.78 .606	-0.997	0.323
	Female	3.89 .579			Private	4.00 .417		

Table 2 shows that the calculated t-values for all domains and the total score do not indicate significant differences between male and female respondents. The significance values (p-values) for all domains are greater than 0.05, suggesting no statistically significant differences in technological competencies between male and female physical education teachers in Palestine.

### 3.3 Results Related to Technological Competencies of Physical Education Teachers in Palestine Due on School Type

The calculated t-values for all domains and the total score do not indicate significant differences between government and private schools. The significance values (p-values) for all domains are greater than 0.05, suggesting no statistically significant differences in technological competencies between physical education teachers in government and private schools in Palestine.

### 3.4 Results Related to Differences in Technological Competencies of Physical Education Teachers in Palestine Due on Years of Experience

The one-way ANOVA test was conducted to analyze the responses of the study sample regarding technological competencies of physical education teachers in Palestine based on years of experience. The results are presented in Table 8.

**Table 3** One-way ANOVA results for technological competencies of physical education teachers in Palestine based on years of experience

Years of Experience	Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	Calculated F-Value	Significance Level
Technology Culture and Use	Between Groups	0.605	3	0.202	0.571	0.637
	Within Groups	18.036	51	0.354		
	Total	18.641	54			
Technology Application Competencies	Between Groups	1.057	3	0.352	0.834	0.481

Years of Experience	Source of Variance	Sum of Squares	Degrees of Freedom	Mean Squares	Calculated F-Value	Significance Level
	Within Groups	21.538	51	0.422		
	Total	22.594	54			
	Between Groups	1.902	3	0.634		
E-Learning Competencies	Within Groups	22.290	51	0.437		
	Total	24.193	54			
	Between Groups	0.910	3	0.303		
Total Score	Within Groups	17.521	51	0.344		
	Total	18.432	54			

The p-values for all domains—Technology Culture and Use, Technology Application Competencies, E-Learning Competencies, and the Total Score—were greater than 0.05, indicating that the differences observed were not statistically significant. This suggests that years of teaching experience do not have a meaningful impact on the technological competencies of physical education teachers in this sample.

#### 4. Discussion

The results indicated that the responses of the study sample reveal that the overall level of technological competencies among physical education teachers in Palestine is high, at 76.23%. The percentages are distributed as follows: the technological literacy and usage domain reached 77.92%, followed by the domain of educational technology applications at 76.65%, and finally the e-learning competencies domain at 74.11%.

The researchers believe that the use of technology has become an essential part of the educational process in physical education, which necessitates that teachers possess technological competencies that contribute to enhancing the quality of education. This calls for empowering teachers to make use of several media and technical instruments. In order to match physical education with 21st-century teaching guidelines, where digital fluency is not only optional but also essential for current learning.

These findings are consistent with previous studies. For instance, Salamah and Jalama (2023) found that physical education teachers rated their technological competencies as high. Similarly, Al-Omari et al. (2020) and Hilal (2019) concluded that teachers showed strong interest and competence in using educational technologies. The consistency among studies points to a regional change in educational policies whereby physical education is progressively using technology tools not just for delivery but also for content enhancement and valuation. Moreover, it supports the idea that among teachers, professional identity now mainly involves digital competency as an essential skill (Ghomi & Redecker, 2019).

We further contend that technology provides opportunities to acquire a range of educational experiences through the use of modern technological teaching tools, thereby enhancing the perception of motor skills more precisely and effectively. Moreover, we found that search engines provide teachers with diverse resources to enrich the educational process and broaden their horizons to keep up with modern developments in their field.

The findings of Salamah and Jalma (2023) demonstrated that physical education teachers possess a high level of competence in operating computers, using word processors for lesson preparation, and employing data show techniques (Salamah & Jalama, 2023). Similarly, a study by Tuluk & Halii revealed that teachers are proficient in online information search strategies, enabling them to select, compare, and interpret the available information and software (Tuluk & Akyüz, 2021). These skills help teachers select and tailor appropriate digital resources to meet their students' needs effectively.

Despite these strengths, the study also identified areas of lower competence. Teachers reported, for instance, a lower confidence in using virtual reality technologies and collaboration platforms. This suggests that while basic digital abilities are well established, more complex or emergent technologies remain underused, probably due to a mix of budget constraints, lack of training, and limited infrastructure.

Additionally, we noted that electronic platforms provide an interactive and collaborative learning environment. To achieve this, it is necessary to establish participatory activities with students to encourage their active engagement. We also believe that electronic platforms are still relatively new in our schools, and that the use of virtual reality remains limited due to the need for specialized facilities, tools, and devices. Our study observed that the lowest score was related to the item "configuring and removing the Office software package"

This could be a reflection of less focus on such technical chores in regular classroom environment. As Heuling et al. (2021) point out, regular use is a major component of digital competency; teachers often feel more competent using tools they use often (Heuling et al., 2021).

A possible explanation of the lower scores in VR and collaborative platforms is that teachers might not see these technologies as required or relevant given the conditions of their present classroom. Studies imply that adoption of technology depends mostly on perceived value (Davis, 1989). Teachers in resource-constrained settings often give tools that are readily available, user-friendly top priority, ones that immediately complement their instructional objectives. Thus, more immersive, resource-intensive tools may be subordinated to technologies such search engines, presentations, and basic e-learning systems (Davis, 1989).

Moreover, we observed that teachers exhibit significant interest in the technological competencies required for the educational process, which explains the absence of statistically significant differences based on gender in the study. It is worth noting that this study's results differ from those of Hilal (2019), which found statistically significant gender differences in technological competencies among physical education teachers in the primary stage at Tanta City, Gharbia Governorate, favoring male teachers (Hilal et al., 2020). The lack of gender-based differences in our findings could reflect improved access to technology and growing equality in digital access and training between male and female teachers in Palestine. The equitable distribution of digital competencies may also be a result of standardized professional development programs offered by the Ministry of Education or NGOs (Al Sabah & Sabah, 2020).

The results also revealed no significant differences based on school type (government vs. private), differing from findings by Ahmed (2019), who reported higher competence in private school teachers in Jordan (Ahmed & Mahmoud, 2019). This may suggest that in Palestine, both private and governmental sectors are increasingly providing equal opportunities for digital professional development. In recent years, initiatives such as the Palestinian Education for Employment project and donor-funded ICT integration programs have attempted to bridge the digital divide across school types (Al Sabah & Sabah, 2020).

Additionally, our results revealed no significant differences based on years of teaching experience. Unlike studies by Al-Omari et al. (2020) and Hilal et al. (2020), which showed superior competences in mid-career or less experienced teachers (Hilal et al., 2020; Mohamed A. Al-Omari et al., 2020). this could be explained by that the expansive move to online learning during the COVID-19 epidemic might have sped up digital skill development in all age and experience levels, therefore lessening these variations. Teachers at all levels were compelled by the epidemic to interact with online technologies, participate in virtual conferences, and apply blended learning strategies (Bozkurt et al., 2020).

In conclusion, our findings are in line with those of Salamah and Jalama (2023), who also found high levels of digital competence among teachers (Salamah & Jalama, 2023). However, they contrast with studies like Hilal et al. (2020), which reported gender-based differences (Hilal et al., 2020). Taken together, these results indicate that Palestinian physical education teachers have embraced many aspects of digital teaching, but further efforts are needed to support the use of advanced technologies such as virtual reality and collaborative platforms. Finally, to sustain and expand these competencies, continuous professional development opportunities must be institutionalized—especially those that focus on emerging tools, practical application, and peer-supported learning communities.

One limitation of this study is the relatively small and localized sample, drawn solely from the Ramallah Governorate. Ramallah is a major urban hub in Palestine and serves as an educational and administrative center, where teachers often share similar training opportunities, curriculum standards, and access to technological resources as those in other Palestinian cities. Thus, this sample may represent national trends in physical education teachers. Future research could benefit from a larger, more diverse sample to enhance generalizability.

## 5. Conclusion

Our study sought to assess the level of technology proficiency among physical education instructors in Palestine. Our results showed that the sample demonstrates high levels of technological proficiency, with no discernible variations according to gender, type of school, or teacher's experience. Furthermore, our research has shown that educators may successfully incorporate digital resources into their lessons; nevertheless, additional training in new technologies is still necessary to maintain high levels of proficiency.

## 6. Recommendations

According to our findings, digital training programs in Palestine should be improved to give teachers advanced technological abilities. In addition, offering ongoing professional development to guarantee that educators stay current with new developments in technology. Additionally, integrate interactive resources and virtual reality into physical education courses. Finally, encouraging collaborative learning settings via digital platforms would be crucial to raising instructors' proficiency in technology.

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## Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

## Author Contribution

*The authors confirm contribution to the paper as follows: **study conception and design:** Amani Asi; Suheir Sabbah; **data collection and interpretation of results:** Amani Asi; **draft manuscript preparation:** Amani Asi; Suheir Sabbah. All authors reviewed the results and approved the final version of the manuscript.*

## Appendix:

Survey questions

No.

Item Content

Technological Literacy and Use

1	The role of educational technology is important in overcoming teaching difficulties
2	I can edit my data and information electronically
3	Educational technology provides me with learning experiences
4	Educational technology is important for developing motor skill visualization
5	I consider individual differences among students when using educational technology
6	I can manage digital information sources
7	I integrate e-learning into lesson planning
8	I can design a technological environment that motivates students to learn motor skills
9	I can design a lesson using computer applications
10	I can create technological educational tools based on students' characteristics
11	I can design interactive computerized lessons for physical education
12	I have knowledge of safety and security rules when using electronic devices
13	I can use multimedia tools in e-learning
14	I am familiar with teaching methods that use technology to present educational content

Technological Applications  
Competencies in Education

15	Handling technological applications through software packages designed for that purpose
16	I use display devices to present electronic lessons
17	I use technological tools in physical education lessons
18	I use smartphone applications in the field of school sports
19	I use the easiest and fastest technologies to teach motor skills
20	I can select the appropriate electronic content to achieve physical education objectives
21	I can provide electronic instructions and guidance to students
22	I encourage students to use the e-learning system
23	I provide safe websites and links to help students understand and interpret topics in physical education

No.	Item Content
24	I upload physical education materials to the school's website
25	I benefit from search engines to enrich information about physical education
26	I can create presentations to motivate students for e-learning
27	I can communicate with students using tools from e-learning platforms
28	I use technological tools that suit students' needs and abilities
29	I simplify concepts to suit students' levels using presentations
<b>E-Learning Competencies</b>	
30	I can install and remove Office software packages
31	I can play sound and video on the computer
32	I can handle printing techniques in devices related to e-learning
33	I can download books and software from the internet
34	I can handle and display the e-course content
35	I use virtual reality technology to teach some motor skills
36	I can participate in specialized electronic forums
37	I can design technological tests that suit students
38	I allow students to view e-test results immediately after completion
39	I ask evaluative questions that stimulate student thinking
40	I continuously apply assessment using e-learning mechanisms
41	I can design interactive educational activities through e-learning platforms
42	I use appropriate e-learning resources for students
43	I use computers in managing administrative tasks related to school sports
44	I benefit from the experiences of others in e-learning

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