

Research Article

Online Education in Physical Education Teacher Education

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Abstract

The inclusion of students with disabilities in general physical education (GPE) has steadily increased, yet many GPE teachers remain underprepared to address their needs effectively. Traditional Physical Education Teacher Education (PETE) programs have attempted to address this gap through the infusion approach, which integrates disability-related concepts throughout the curriculum. While this model is effective in strengthening pre-service teacher preparation, challenges such as time constraints and financial limitations restrict its broader implementation. In light of these challenges, digital learning has emerged as a promising alternative. This study reviewed research published since 2021, accessed through the ERIC database, using broad search terms including “e-learning” and “online education.” Findings indicate that when carefully designed, online learning environments can be as effective as face-to-face instruction, particularly in promoting engagement, knowledge retention, and skill development. The review emphasizes that incorporating disability-focused content into online PETE courses could overcome some of the resource barriers associated with traditional instruction. Moreover, best practices in online learning, such as interactive content and flexible delivery methods, offer opportunities to enhance pre-service teacher readiness. This study highlights the potential of digital platforms to advance inclusion efforts in PETE and outlines directions for future implementation.

Keywords

Physical Education Teacher Education, Infusion Approach, Online Learning, Disability Inclusion, Teacher Training

1. Introduction

Over 7.5 million students with disabilities received special education and related services under the Individuals with Disabilities Education Act (IDEA) during the 2022-2023 school year, accounting for 15% of all public school students aged 3-21 [27]. With the ongoing shift away from segregation policies, the inclusion of students with disabilities in general physical education (GPE) settings continues to rise. However, since findings indicate that General Physical Education (GPE)

teachers have not been adequately prepared to work with students with disabilities [18, 29, 34], it is doubtful that Physical Education Teacher Education (PETE) programs in higher education provide appropriate training to PETE students regarding dealing with students who have disabilities and are in their GPE classes [15]. While previous reviews, such as Hutzler and Choresch (2024), have broadly examined online learning in higher education, they have not specifically

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addressed the intersection of online education, teacher training, and physical education in the post-pandemic era [15]. This review uniquely synthesizes recent empirical studies to highlight emerging trends, challenges, and opportunities within these fields. By narrowing the scope to these critical areas, it is critical to understand how online modalities impact PETE program.

The infusion approach, which integrates disability-related concepts throughout the PETE curriculum, has been implemented in various institutions [20]. In the early 1990s, apprehensions about the inadequate state of teachers' preparation for working with disabled students in GPE classes prompted studies that used the infusion approach in PETE programs. The infusion approach incorporates disability-related concepts into the overall PETE curriculum; this means that teaching and training programs such as PETE and Adapted Physical Education (APE) would no longer provide a segregated curriculum [19]. For example, Adelphi University (NY) and Washington State University integrated the infusion model into their PETE program [12]. They employed various methods to implement this model, such as inviting guest lecturers, providing practicum, and using simulations to enhance understanding of certain concepts of disability. Through their subsequent experiences, the students were exposed to many different instructional strategies and activity modifications. Modifications were made daily to encourage students to individualize their instruction when planning their own lessons. The students were also asked to simulate their own lesson plans. West Chester University (PA) invited guest speakers into courses such as the foundations of physical education [20, 21]. Although universities and faculty have begun integrating disability concept into PETE programs, numerous barriers, such as time constraints and financial limitations, persist. Specifically, providing APE content online requires professors to add course materials and assignments, which may increase the overall workload. This often leads to the need for additional in-person class time or scheduling adjustments. Consequently, students must engage with extra materials, potentially necessitating more live lectures or face-to-face sessions—both of which can be challenging to coordinate due to faculty and program limitations. According to Rizzo and Kirkendall (1995), the PETE curricula must be changed to create a new infusion-approach curriculum.

Considerable research has been conducted to find alternative instructional methods to meet university and student needs. To overcome these barriers, online education has been used to enhance general education curricula [37, 39]. When integrated into learning modules, special education issues can be infused into traditional elementary and secondary preparations [38]. Many higher education institutions offer online courses in degree programs through interactive multimedia and the Internet. While these courses and programs are increasing in popularity, many educators and trainers still question the merits of online learning and try to root out the difficulties associated with online teaching and learning [11].

This study reviews research on the effectiveness of online

learning in higher education. Specifically, it addresses three primary questions: (a) what is the rationale for using this teaching environment in terms of satisfaction, cost-effectiveness, and general effectiveness? (b) what do experts and research studies say regarding the best practice in creating an online environment, and finally, and (c) what direction should one take to infuse disability concepts in PETE program via an online supplement.

2. Methods

Relevant research investigating online learning in higher education was identified through a search of the Educational Resources Information Center (ERIC) database for primary peer-reviewed research materials published since 2021. To ensure that no relevant studies were overlooked, the search terms remained broad. The search terms “e-learning” and “online education” were applied specifically to the title and abstract fields. Conference proceedings, editorials, and non-English articles were excluded. Duplicate records across databases were identified and removed using reference management software, Zotero. Relevance was assessed through an initial title and abstract.

According to these studies, the difference between traditional face-to-face instruction and online learning is analyzed mainly in terms of cost-effectiveness, learner satisfaction, and outcomes. The next step was a detailed examination of the papers, which included the terms “higher education,” “teacher training,” and “physical education.” This was conducted to review studies in the field of teacher education, specifically those addressing higher education.

3. Results

By using the search term “online education,” 20,351 studies were searched. Similarly, 14,752 studies used “e-learning.” With the “online course,” “teacher education,” and “physical education” 84 studies were found.

3.1. Why Online Learning

The use of email and the Internet coupled with web-based courses has become a core instructional method, particularly in higher education [2, 13]. Online learning leverages network technologies, such as the Internet, to deliver, support, and assess formal and informal instruction [36]. One of the primary reasons for using online learning is access and flexibility; Learners can log in from any computer terminal, at home or work, at any time to complete lessons or review learning materials. Faster content delivery and cost savings are additional benefits. For organizations that need to disseminate rapidly evolving information (e.g., updated software), online modules are often more cost-effective than traditional in-person training [7]. Moreover, current academic and busi-

ness environments in the global economy view the implementation of online education and training programs as a necessary avenue for training and implementing programs across the global network [9]. Changes in society and the increasing need to train and retain people mean that the need to teach and learn flexibly will only grow [36].

Therefore, the last decade has pushed institutions of higher education worldwide to recognize online learning as a viable alternative (or supplement) to traditional classroom instruction [24, 40]. For example, a recent report on online learning trends indicated that the shift toward digital instruction has accelerated significantly due to the COVID-19 pandemic, with the majority of institutions expanding their online offerings [35]. Furthermore, online enrollment continues to rise, with research indicating that over 50% of United States (U.S.) postsecondary students now take at least one online course annually [3].

3.2. Compare Online vs. Traditional Face-to-face Learning Environment

The efficacy of online learning has been extensively studied, yielding varied outcomes. Recent systematic reviews have evaluated online learning effectiveness during the COVID-19 pandemic and identified factors influencing student performance in digital environments [41]. Meta-analyses have found that, on average, students in online learning conditions perform slightly better than those who receive face-to-face instruction [25].

A previous study compared an online graduate course with an equivalent course taught in a traditional face-to-face format [16]. This study emphasizes the stark differences between the two learning environments and questions how instructional designs could be optimized to maximize learning opportunities and achievements in both settings. The results revealed no significant differences in learning experiences, perceptions of student-instructor interaction and course support, or learning outcomes (i.e., perceived content knowledge, quality of course projects, and final course grades) in online and face-to-face learning environments.

Maki et al. (2000) examined undergraduate psychology students' performance in online and face-to-face courses. The study found that students in online sections acquired more content knowledge and performed better on in-class examinations than those in traditional lectures. Additionally, online students reported increased internet usage and reduced computer-related anxiety, highlighting the potential benefits of online instruction in enhancing digital literacy and comfort.

Recent studies have explored the effectiveness of online versus traditional instructional methods in teacher preparation programs. For instance, Alzahrani (2022) compared university students' performance in traditional learning environments with that in online settings during the COVID-19 pandemic. Overall, the findings indicated no significant differences in student academic outcomes between the two

modalities. However, the study noted that online discussions often led to increased student participation compared to face-to-face discussions, suggesting that online platforms encourage more inclusive student engagement.

3.3. Cognitive Learning

Al-Baadani and Abbas (2022) examined medical students' experiences transitioning from on-site to online learning. The study involved 1,000 participants, 500 students enrolled in on-site learning and 500 in online instruction. Performance was assessed through final examination scores, whereas satisfaction was measured using a standardized course evaluation survey. The results showed that students in the online cohort achieved higher mean exam scores (91.76%) than on-site group students (88.58%). Similarly, Batool et al. (2023) compared online and traditional learning methods among 500 university students to assess instructional effectiveness. This study found that online learning platforms were equally effective as traditional classroom settings in terms of student performance.

These findings align with earlier research by Means et al. (2009), who conducted a meta-analysis of online learning studies and found that, on average, students in online learning conditions performed marginally better than those who received face-to-face instruction. The analysis suggests that the effectiveness of online learning is influenced by factors such as the inclusion of collaborative learning opportunities and instructor involvement.

Smith et al. (1999) investigated the effectiveness of traditional instructional methods delivered online in the context of teacher preparation. This study revealed no significant differences in the learning outcomes between online and traditional classroom settings, suggesting that traditional instructional strategies can be effectively adapted to online platforms. Notably, the research also found that online discussions fostered greater student participation, which aligns with other studies highlighting the interactive potential of online learning environments.

3.4. Student Satisfaction

In addition to learning outcomes, researchers have explored student satisfaction in the affective domain, including attitudes toward learning environments. A meta-analysis suggested a slight student preference for traditional educational formats over online education with minimal differences in satisfaction levels [4]. However, a recent study found that approximately 60% of students perceived online learning as an effective method for acquiring knowledge and staying on track with coursework [26]. These discrepancies suggest that students' satisfaction with online learning varies across contexts and populations.

Batool et al. (2023) indicated that students' satisfaction with online and face-to-face instruction varies, with some

students preferring the flexibility of online learning and others favoring direct interaction in traditional classrooms. This finding reinforces the notion that, while performance outcomes may be comparable, individual preferences significantly influence perceived satisfaction.

Recent studies indicate that students' perceptions of online learning are generally positive, particularly regarding the flexibility and accessibility it offers [8, 23, 28]. However, key factors such as social interaction, instructor presence, and course design continued to significantly influence student satisfaction and engagement. For instance, students who perceive a strong instructor presence and receive timely feedback tend to report higher motivation and improved learning outcomes [22]. Additionally, well-structured course designs incorporating interactive elements such as discussion

forums, group projects, and multimedia resources enhance student engagement and mitigate feelings of isolation [33]. While online learning provides flexibility, addressing these factors remains essential to ensure a high-quality educational experience.

Some researchers have used correlational studies to examine the relationships between learner characteristics, online learning environments, and overall satisfaction [17, 28]. Their findings suggested that prior experience with digital tools, social interaction quality, and learning styles influence student satisfaction. Notably, individuals with prior experience and training in technology-related fields reported higher comfort and satisfaction levels in online learning environments. However, challenges persist regarding the effective implementation of online teaching and learning methodologies.

Table 1. Key Considerations for Implementing Online Learning in PETE and APE Programs.

Year	Authors	Topic	Key Findings
1999	Smith et al.	Effectiveness of traditional instructional methods delivered online in teacher preparation.	No significant differences in outcomes; online discussions fostered greater participation.
2000	Johnson et al.	Comparison of online graduate course vs. traditional face-to-face course.	No significant differences in learning experiences, interactions, or outcomes.
2000	Maki et al.	Undergraduate psychology students' performance in online vs. face-to-face courses.	Online students acquired more content knowledge, performed better, and reported less computer anxiety.
2002	Allen et al.	Meta-analysis on student satisfaction with online vs. traditional learning.	Slight preference for traditional formats, but minimal satisfaction differences.
2003	Derrik	Use of email, Internet, and web-based courses in higher education.	Technology became a core instructional method.
2003	Aragon	Cost-effectiveness of online modules for rapidly evolving information.	Online modules were more cost-effective than in-person training.
2004	Shank & Sitze	Definition and benefits of online learning; flexibility and access.	Highlighted access, flexibility, faster delivery, and cost savings.
2004	Bartley & Golek	Online education in global academic and business contexts.	Viewed online education as necessary in a global economy.
2009	Means et al.	Meta-analysis on effectiveness of online vs. face-to-face learning.	Online learners performed slightly better; collaborative and instructor-led designs improved outcomes.
2016	Ngampornchai & Adams	Student perceptions of online learning.	Prior experience and digital literacy influenced satisfaction and comfort.
2020	Xu & Jagers	Online learning as a viable alternative.	Recognized as a valid option or supplement to traditional instruction.
2021	Means & Neisler	Online learning trends in higher education.	Institutions increasingly recognized online learning as legitimate.
2021	Allen & Seaman	Online enrollment in U.S. postsecondary institutions.	Over 50% of students took at least one online course annually.
2021	Nakhoda et al.	Student perceptions of online learning effectiveness.	About 60% perceived online learning as effective.
2021	Baber	Flexibility and accessibility of online learning.	Students appreciated flexibility and accessibility.

Year	Authors	Topic	Key Findings
2021	Kim & Kim	Learner characteristics and satisfaction in online learning.	Tech experience and learning style strongly influenced satisfaction.
2022	Seaman et al.	Report on online learning trends during COVID-19.	Institutions rapidly expanded online offerings during the pandemic.
2022	Al-Baadani & Abbas	Medical students' transition from on-site to online.	Online cohort scored higher and reported higher satisfaction.
2023	Zhang & Chen	Systematic review of online learning effectiveness during COVID-19.	Identified multiple factors influencing performance in digital environments.
2023	Batool et al.	Comparison of online and traditional instruction.	Both modes were equally effective; satisfaction varied by preference.
2023	Ratten	Impact of course design on student engagement.	Interactive and well-structured designs enhanced participation and reduced isolation.
2024	Li & Wang	Instructor presence and feedback in online learning.	Strong instructor presence and timely feedback improved motivation and outcomes.

4. Conclusion

These findings underscore the effectiveness of online instruction in teacher preparation programs, particularly when traditional teaching methods are adapted for digital platforms. Increased participation in online discussions suggests that such formats foster more inclusive and engaging learning experiences. As educational institutions continue to integrate online components into their curricula, it is essential to consider strategies for optimizing these platforms to support effective teaching and learning outcomes.

In summary, recent research indicates that online learning can match or even surpass traditional on-site instruction in terms of student performance. Student satisfaction varies according to individual preferences and specific course implementation. These studies highlight the importance of considering both performance outcomes and personal preferences when designing and implementing online and on-site educational programs.

The findings show that online learning can be comparable to face-to-face learning. Despite these benefits, questions remain regarding the successful implementation of an online learning environment. In light of these findings, several considerations pertaining to the future of online programs have emerged.

4.1. Creating and Implementing a Successful Online Learning Environment

Curriculum and instruction. Learning is an interactive and evolving process regardless of the setting. There are indications that online instruction can be as effective as other methods, namely face-to-face instruction. Nonetheless, online

instruction may not be suitable for courses that require a high degree of student-instructor interaction [30]. The determining factor is how the curriculum designer integrates sound learning principles into the online learning environment [1].

Faculty support. Instructional programs that lead to degrees are organized around substantive and coherent curricula. A standard practice for online program instructors is to post a detailed syllabus on a course website. Furthermore, the instructor should include a roadmap for the course, mainly his or her expected outcomes [5, 6]. Faculty invest significant time in course development, maintenance, and presentation, including responding to emails, providing feedback, and managing discussion platforms. Given these demands, the university should acknowledge and support faculty in these efforts.

Student support. Research indicates that online students need technical knowledge and skills to successfully participate in online programs [14]. Institutions offering online programs should provide the necessary training to students before and during their participation in an online program. Technical support should also be provided.

Successful online instructor. Even when an institution follows the best practices, the true impact of the learning experience relies heavily on online instructors [10, 31]. First, instructors should possess a broad array of life experiences and academic credentials to provide students with real-life examples. Some of the better instructors were program adjunct professors, consultants, or teachers. They were active practitioners who brought a wealth of experience to the classroom, which was especially helpful in providing tips on applying concepts to the real world. Second, the instructor should demonstrate a sense of openness, concern, flexibility, and sincerity.

Online instructors should gain first-hand experience with online learning. Online instructors must develop new instructional skills (primarily related to the use of technology)

and refine and augment existing skills (feedback, communication, innovation, courseware design, among others). Educational institutions can support instructors in new online programs by providing training in technology integration, instructional strategies, and teaching methods. Student Support Institutional addresses students' needs related to their academic success and provides the necessary help.

4.2. Direction to Infuse Disability Concept in PETE Program via Online Supplement

Although many studies have reported admirable cost savings and comparable outcomes in online learning compared with face-to-face instruction, universities continue to struggle with making online learning truly effective [32]. This challenge is especially relevant for Physical Education Teacher Education (PETE) and Adapted Physical Education (APE), where experiential learning, skill demonstration, and inclusive practice are central. To improve effectiveness, it is critical to understand how to integrate the essential characteristics of PETE and APE into online environments.

Understanding the content area. Online supplements are most effective when they are intentionally aligned with course content to extend and reinforce in-class learning. For instance, modules that focus on locomotor and object control skills can provide specific guidance on modifying equipment and strategies for students with disabilities. Similarly, when covering classroom and behavior management, online materials can enrich instruction through practical examples such as picture schedules, reward systems, and token economies designed for diverse learners. These resources deepen students' understanding and ensure that content delivery is directly applicable to inclusive teaching practices.

Facilitate discussion not only online but also face-to-face. Limited interaction between faculty and students is one of the main challenges in online learning. To overcome this, instructors can adopt interactive strategies such as online chats, discussion boards, and conference calls that complement in-person learning. At the same time, structured opportunities for students to ask questions during face-to-face sessions can strengthen engagement. By blending these approaches, instructors create a supportive and dynamic learning environment that bridges the virtual and in-person divide, encouraging student participation and deeper comprehension.

Give hands-on experiences. Effective PETE and APE instruction requires balancing indirect learning activities with direct, experiential opportunities. Online education can provide articles, reflective activities, and video-based analysis to build conceptual knowledge, but it must also integrate practical experiences such as laboratory work, practicum observations, and adaptive sport simulations. These hands-on opportunities ensure that students move beyond theory, developing the applied skills necessary to succeed in real-world teaching contexts.

To ensure successful implementation, faculty should assess

student readiness through surveys that explore career goals and familiarity with online learning, and pilot-test courses to refine content and delivery. While traditional programs will likely persist, the integration of online components is reshaping teacher preparation, yet few studies have examined this shift in PETE and APE. Future research should focus on developing and testing online modules that not only deliver content but also create meaningful, practical experiences that prepare both pre-service and in-service teachers for inclusive, innovative practice.

To further ensure successful implementation, faculty should assess student readiness through surveys that examine career goals and familiarity with online learning. Pilot-testing courses and refining delivery strategies based on feedback are essential steps for building effective and sustainable programs. While traditional PETE and APE programs will likely continue to play a dominant role [33], online education is increasingly reshaping teacher preparation. Many institutions now supplement in-person instruction with online coursework (Al-Baadani & Abbas, 2022), yet few studies have directly examined this shift in PETE and APE. Future research should prioritize the development of specialized online modules that combine content mastery with practical experiences to prepare both pre-service and in-service teachers for inclusive and innovative practice.

Traditional programs will probably never disappear, but the learning process will change [33]. Many institutions use online courses as a component of their programs but still require students to complete part of their coursework in residence (Al-Baadani and Abbas, 2022). However, few studies have used online courses on the PETE and APE in higher education. Online education has the potential for the future training of in-service teachers to introduce new laws, teaching strategies, and equipment. Future studies should focus on developing modules specifically designed for PE and APE that not only enhance the understanding of the content but also provide rich experiences for pre-service and in-service PE/APE teachers.

Abbreviations

GPE	General Physical Education
PETE	Physical Education Teacher Education
APE	Adapted Physical Education

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Eun Hye Kwon: Conceptualization, Methodology, Data

curation and Formal analysis, Writing - Original draft

Taeung Kim: Investigation, Writing - Original draft, review, & editing

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Conflicts of Interest

The authors confirm that this study was carried out without any commercial or financial involvement that could be perceived as a potential conflict of interest.

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