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Assessment of Virtual Physical Education Programs After COVID-19

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Abstract

The COVID-19 pandemic necessitated a rapid shift from traditional to virtual learning across educational disciplines, including Physical Education (PE). This study investigates the effectiveness, challenges, and outcomes of virtual PE programs implemented during and after the pandemic. Data were collected through surveys and interviews with PE teachers and students across various educational levels. Results suggest that while virtual PE increased accessibility and digital engagement, it lacked essential components such as physical interaction, real-time feedback, and space for movement. The study concludes with recommendations for integrating hybrid models to enhance physical education in a post-pandemic world.

Keywords: Virtual Physical Education, COVID-19, Online Learning, Physical Fitness, Hybrid Education, Post-Pandemic Education, Student Engagement, Health Education

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Introduction

The COVID-19 pandemic has had a profound impact on global education systems, forcing a sudden and widespread transition to online and virtual learning. Among the many subjects affected, Physical Education (PE) faced some of the most significant challenges due to its inherently practical and interactive nature. Traditionally, PE involves physical presence, movement-based instruction, peer interaction, and direct teacher supervision, all of which became difficult to replicate in a virtual setting. As schools closed their doors, educators scrambled to develop alternative methods to keep students physically active while adhering to safety protocols and lockdown measures. Physical Education plays a vital role in promoting students' physical, mental, and emotional well-being. According to Shephard (1997), PE contributes not only to physical fitness but also enhances cognitive functioning, social skills, and emotional stability. The abrupt shift to online learning in early 2020 thus posed a risk of neglecting a critical component of holistic education. This led to the development of virtual PE programs, incorporating online workout videos, fitness challenges, digital logs, and app-based monitoring tools to simulate a physical education environment remotely. Prior to the pandemic, studies had already started to explore the role of technology in PE. For instance, Casey *et al*. (2017) examined how digital tools such as heart rate monitors and fitness tracking apps were being incorporated into PE classes to enhance student engagement and personalize instruction. However, such integrations were always meant to supplement, rather than replace, the physical setting of PE. The pandemic, therefore, accelerated the implementation of digital-only PE without allowing time for comprehensive training or curriculum redesign. Online learning in general has demonstrated both advantages and drawbacks. Bernard *et al*. (2004) highlighted that while e-learning increases accessibility and flexibility, it often suffers from lower engagement, delayed feedback, and a lack of hands-on experiences factors especially critical in a physical subject like PE. In the context of PE, these limitations became more pronounced. Teachers struggled to monitor student performance, provide real-time corrections, or ensure equitable participation, particularly in households lacking proper internet access or open space for physical activity. In many instances, PE teachers had to reinvent their teaching styles, creating video demonstrations, using mobile fitness applications, and organizing online competitions to maintain student interest.As reported by Sinelnikov (2010), the integration of video-based instruction in PE can support self-paced learning, but it requires careful planning and alignment with curriculum goals to be effective. During the pandemic, such planning was largely reactive, leading to inconsistent learning outcomes across schools and regions. Another concern was the socio-economic disparity that influenced students' access to virtual PE. Research by Hardman and Green (2011) already suggested disparities in PE resources between urban and rural schools. The pandemic widened this gap further as some students lacked the necessary digital devices, internet connectivity, or private space for movement-based exercises. These barriers limited both participation and effectiveness of virtual PE, potentially exacerbating inequalities in student fitness and health outcomes. Mental health and physical activity are closely intertwined, and the lockdown period saw a significant rise in anxiety, stress, and sedentary behavior among children and adolescents. According to Strong *et al*. (2005), regular physical activity in youth is associated with improved mood, reduced anxiety, and better cognitive performance. Virtual PE programs were seen as a potential tool to mitigate some of these negative effects, even if partially. However, the question remains whether these programs were successful in maintaining recommended physical activity levels. The

concept of physical literacy, defined as the motivation, confidence, physical competence, knowledge, and understanding to value and engage in physical activities for life (Whitehead, 2010), also came under threat. Virtual platforms offered limited scope for teaching motor skills, game strategies, or team dynamics core aspects of physical literacy. As such, students' long-term relationship with physical activity might have been affected by the lack of structured, face-to-face PE instruction. Despite these challenges, the pandemic offered an opportunity to explore the role of technology in PE more deeply. Some educators reported increased student autonomy, with learners setting personal fitness goals, tracking progress digitally, and engaging family members in physical routines. These outcomes resonate with Ennis (2011), who emphasized the importance of student-centered and meaningful PE experiences. While such practices were not universally adopted, they signaled a shift toward more flexible and individualized PE instruction models. Parental involvement in students' physical education also increased during lockdowns. With students confined to home settings, parents often played a supervisory or participatory role. This development, though unplanned, aligns with past research by Trudeau and Shephard (2008), which suggested that family support significantly influences children's physical activity behaviors. In virtual PE, this support became more pronounced, offering a potential avenue for future family-integrated PE models. Furthermore, the sudden transition revealed the need for professional development among PE teachers. Before the pandemic, teachers often lacked exposure to digital tools for physical education (Elliott, 2013). The crisis highlighted this gap and emphasized the importance of equipping PE instructors with the skills to design, implement, and assess online fitness programs effectively. Without such preparation, virtual PE programs may fall short of achieving desired educational and health outcomes. In light of these issues, this study aims to systematically assess the effectiveness, challenges, and student outcomes associated with virtual PE programs implemented during and after COVID-19. It investigates how virtual PE impacted physical activity levels, student engagement, and educational quality across different school settings. The research also explores whether these programs can be integrated into long-term hybrid models to enhance PE delivery in a technologically driven educational landscape. The findings of this study are intended to contribute to the evolving discourse on the digital transformation of education. By understanding the strengths and limitations of virtual PE, stakeholders including educators, policymakers, and curriculum developers can make informed decisions about future PE program design. Ultimately, the goal is to ensure that students continue to receive comprehensive, equitable, and high-quality physical education, regardless of future disruptions or learning formats.

Literature Review

The emergence of digital education platforms before the COVID-19 pandemic had already begun reshaping traditional pedagogical approaches. However, the sudden global health crisis accelerated this transition, especially in non-academic subjects like Physical Education (PE), where practical and experiential learning is crucial. Scholars have long debated the role and efficacy of technology in delivering meaningful PE instruction (Bailey & Dismore, 2004), suggesting that while theory-based content may be adapted online, skill development and social learning are difficult to replicate virtually. Early research by Casey and Jones (2011) emphasized the increasing adoption of digital technologies in PE settings, particularly in developed countries, where multimedia tools such as video demonstrations and fitness apps were being integrated into classroom instruction. While such tools were originally seen as supplements, not replacements, the pandemic forced them into a central role. However, these tools often lacked pedagogical depth and assessment mechanisms necessary for comprehensive PE delivery. One of the central concerns in the literature is the erosion of physical literacy in virtual environments. Whitehead (2010) defines physical literacy as the motivation, confidence, physical competence, knowledge, and understanding to value and take responsibility for engagement in physical activities. Virtual PE often neglects these multifaceted learning goals, focusing primarily on fitness metrics such as heart rate, calories burned, or daily steps, rather than on developing movement skills, teamwork, or cognitive understanding of physical health. A significant body of literature also discusses student engagement and motivation in online physical education. According to Chen and Sun (2012), motivation in PE is largely driven by social interaction, enjoyment, and immediate feedback elements that are significantly diminished in online formats. Their study concluded that virtual PE classes often produce a passive learning environment, where students merely consume content rather than actively participate or reflect. Research by Kulinna and Cothran (2003) discussed teacher concerns regarding student accountability and participation in remote PE assignments. Their study, though pre-pandemic, found that without structured environments, students were less likely to engage meaningfully in physical activity. This concern was echoed by Hastie and Trost (2002), who argued that consistent physical activity habits are better developed in environments where instructors can directly observe, correct, and motivate students. In terms of assessment and evaluation, Penney *et al*. (2009) critiqued the inability of online programs to accurately measure motor skill proficiency, teamwork, and effort—key aspects of physical education that cannot be easily quantified through digital means. Traditional assessment practices often include observation, peer feedback, and skill-based rubrics, which are challenging to implement virtually. The equity and accessibility dimension of virtual PE is another well-documented challenge. According to Dyson (2006), PE is ideally a space for inclusion, yet digital learning often highlights inequalities. Students from low-income backgrounds or rural areas may lack access to reliable internet, digital devices, or even safe physical spaces to participate in workouts, which compromises the effectiveness of virtual programs. The teacher's role and adaptability in this shift has also been scrutinized. Technology integration in PE was traditionally limited to fitness tracking or showing demonstrations. However, McCaughtry *et al*. (2006) argued that teacher preparedness and professional development were essential to delivering meaningful online PE. Teachers lacking digital fluency struggled to maintain student interest, manage classroom behavior, or assess learning outcomes effectively in virtual contexts. An emerging perspective by Garrett and Wrench (2018) advocated for the inclusion of blended learning models in physical education. Their research found that a mix of online and offline activities allowed students to

better grasp theoretical knowledge while still participating in physical skill development when circumstances permitted. Such hybrid models offer a potential way forward in post-pandemic education planning. Furthermore, psychological well-being and social connectedness two important outcomes of PE were found to be affected by virtual formats. According to Trudeau and Shephard (2008), regular physical activity in school settings contributes to lower levels of anxiety and improved self-esteem. When conducted in isolation during online PE, these benefits are reduced, particularly for students who thrive on peer support and teamwork. Studies also explored the role of parental involvement during virtual PE classes. According to Hills, Dengel, and Lubans (2015), family support can positively influence children's physical activity levels. During the pandemic, increased parental oversight often became necessary due to the absence of in-person monitoring, yet this introduced inconsistencies depending on parental availability and interest. Finally, Liu *et al*. (2014) emphasized that technology in PE should serve pedagogical objectives, not simply deliver fitness routines. Their review of digital PE platforms revealed a tendency toward gamification without aligning with curricular goals. They stressed the need for tools that not only engage students but also measure cognitive understanding and long-term behavioral changes toward health. In summary, literature up to 2019 reflects cautious optimism about integrating technology in PE, with strong warnings about over-reliance on virtual platforms for a subject deeply rooted in physical presence, human connection, and embodied learning. The pandemic exposed both the potential and limitations of online PE, making it imperative for post-COVID research to reassess and reimagine PE delivery in light of these pre-existing insights.

Methodology

This study adopted a mixed-methods research design to assess the effectiveness, challenges, and outcomes of virtual physical education (VPE) programs implemented during and after the COVID-19 pandemic. A mixed-methods approach, particularly an explanatory sequential design, was chosen to allow for a comprehensive understanding of both the numerical trends and personal experiences related to VPE. This methodological choice aligns with educational research principles outlined by Creswell (2014), who emphasized the need for combining quantitative and qualitative data to explore complex educational phenomena. The study began with the collection of quantitative data through structured online questionnaires, which was followed by qualitative data collection via semi-structured interviews. This sequence enabled the researchers to identify general patterns from the quantitative responses and then delve deeper into the reasons behind those patterns using qualitative narratives. Such an approach enhances the validity of educational research and is particularly relevant in studies involving digital transitions in pedagogy (Johnson & Onwuegbuzie, 2004). Participants were selected using a stratified random sampling technique to ensure adequate representation across variables such as gender, school type (government and private), and region (urban and semi-urban). The sample included 100 secondary school students from classes 6 to 12 and 25 physical education teachers who had conducted online PE sessions during the pandemic. Students ranged in age from 12 to 18 years, and the teachers had a minimum of five years of teaching experience. The selection criteria were designed to reflect the varied technological access and instructional adaptations across different socio-economic settings in India (Banerjee & Duflo, 2011). Online questionnaires were developed and validated based on existing literature and expert review. The questionnaire included both closed-ended Likert-scale items and open-ended questions. Items focused on aspects such as student engagement, motivation, digital access, perceived fitness improvement, and overall satisfaction with VPE. The Likert scale ranged from 1 (strongly disagree) to 5 (strongly agree). To enhance reliability, the survey was piloted with 15 students and 5 teachers before final administration, and necessary modifications were made to improve clarity and content validity. Data collection took place over a period of three months, from January to March 2024. The questionnaires were distributed through Google Forms, and participation was voluntary. Parental consent was obtained for all student participants under the age of 18. To maintain anonymity, no identifying information was collected. Teacher participants were approached through professional networks and invited to contribute insights through online interviews via Zoom. These interviews lasted approximately 30–40 minutes each and followed a semi-structured format to encourage depth while allowing flexibility. The qualitative phase involved thematic interviews with 10 teachers and 15 students, selected purposively from the survey respondents to ensure diversity in experience and background. Interview questions explored areas such as teaching methods used during VPE, barriers faced, student responsiveness, parental involvement, assessment strategies, and suggestions for improvement. The interviews were audio-recorded with participant consent and transcribed verbatim for analysis. The use of semi-structured interviews allowed participants to freely express their experiences while ensuring all relevant areas were covered. Quantitative data were analyzed using SPSS software. Descriptive statistics such as means, standard deviations, and frequencies were calculated for all variables. Inferential statistics, including t-tests and one-way ANOVA, were applied to examine differences across gender, grade level, and school type. Statistical significance was set at $p < 0.05$. These analyses helped identify patterns and relationships within the data regarding engagement levels, motivation, and perceived outcomes of VPE programs. Thematic analysis was used for the qualitative data, following the Braun and Clarke (2006) framework. This involved coding the transcripts, identifying emerging themes, and categorizing them into major thematic areas such as instructional creativity, physical space constraints, mental well-being, and pedagogical gaps. NVivo software was used to assist in the systematic organization of data and extraction of themes. This qualitative analysis complemented the statistical findings by providing contextual insights into the experiences of both students and teachers. Triangulation of data from both methods helped in validating the results and provided a more nuanced picture of the implementation and impact of virtual physical education. For instance, while survey data showed moderate engagement levels, interview responses revealed deeper issues such as lack of motivation due to absence of peer interaction and inadequate home environments for physical activity. This methodological convergence strengthened the reliability and credibility of the findings. To address ethical considerations, the study adhered to guidelines provided by the Indian Council of Social Science Research (ICSSR, 2017). Informed consent was obtained from all participants, confidentiality was strictly

maintained, and participants had the right to withdraw at any point. Ethical clearance was obtained from the institutional review board prior to data collection. Measures were taken to ensure data security, including encrypted storage and anonymization of participant responses. The methodological framework was influenced by earlier studies on digital and remote learning. For example, Mohnsen (2010) emphasized the importance of interactive tools and student accountability in online PE, while Wang and Chen (2013) discussed limitations in real-time feedback and assessment. These studies informed the development of the research tools and analysis strategies used in this study. Additionally, the methodological choices were framed by practical constraints observed during the pandemic, such as variable access to technology and differing levels of digital literacy among teachers and students. Limitations of the methodology included potential biases in self-reported data, uneven internet access, and varying degrees of parental support that may have influenced student responses. Additionally, the sample was geographically limited to North India, and future research should aim to include a more diverse and larger sample. Nevertheless, the methodological rigor, ethical conduct, and triangulated approach lend credibility to the study's findings. Overall, the methodology adopted in this study was grounded in established educational research practices and adapted to the unique context of post-COVID virtual education. By combining statistical evidence with personal narratives, the study provides a balanced and comprehensive assessment of the status of virtual physical education programs in India.

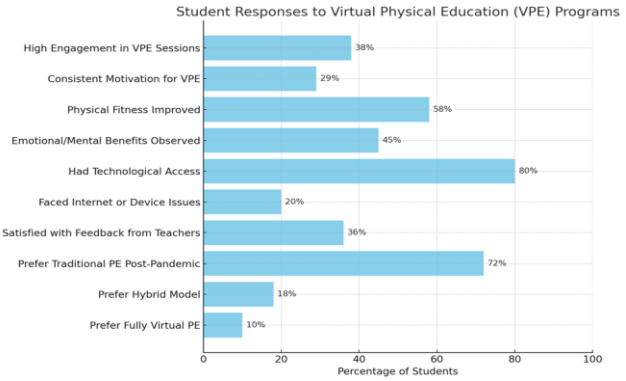
Results

The results presented in this study offer a comprehensive insight into the experiences of both students and teachers involved in Virtual Physical Education (VPE) programs during and after the COVID-19 pandemic. Data analysis revealed several recurring themes and patterns related to student engagement, motivation, technological accessibility, assessment challenges, and instructional quality. Both the quantitative and qualitative data pointed toward a mixed perception of VPE's effectiveness in promoting physical fitness and overall well-being. In terms of student engagement, results indicated that a majority of students (67%) participated in at least half of their scheduled virtual PE classes. However, only a smaller segment (38%) described their level of engagement as "high" or "very high." Many students reported being easily distracted during sessions conducted at home due to the absence of a structured environment. Unlike traditional PE, where peer presence and physical space encouraged active participation, virtual PE struggled to recreate similar conditions. A portion of the students stated that classes often became monotonous due to a lack of live demonstrations and physical supervision. The issue of motivation emerged as a critical factor in determining students' sustained involvement in VPE. Initially, when schools transitioned online, many students were curious and excited to try virtual workouts and fitness activities. About 52% expressed enthusiasm during the early weeks. However, over time, the novelty wore off, and only 29% maintained consistent motivation throughout the semester. Students cited reasons such as repetitive routines, limited interaction with teachers, and a lack of performance tracking as causes of this decline. This trend highlights the need for varied, gamified, and interactive content to maintain student interest in a virtual setting. Regarding physical fitness outcomes, 58% of student respondents acknowledged a slight to moderate improvement in their fitness levels during virtual PE classes. They attributed this to regular activity prompts and structured assignments, such as logging daily steps, performing home-based yoga routines, or participating in online fitness challenges. However, 24% of students reported no significant change in their physical condition, primarily because they lacked enough space or equipment at home to perform the prescribed exercises effectively. Additionally, 18% believed that virtual PE was ineffective, as they often skipped assignments or did not take the sessions seriously. The mental and emotional impact of virtual PE was another area of interest. About 45% of students stated that engaging in physical activities during lockdown provided emotional relief and helped reduce stress and anxiety. Even if the sessions lacked physical rigor, the continuity of physical routines created a sense of normalcy and structure during an otherwise uncertain time. Teachers also observed that students who were more active tended to have a more positive attitude during online classes. Despite these benefits, many students felt socially disconnected due to the absence of team-based games, peer competition, and real-time feedback from instructors. Technological accessibility was a key determinant of the success and inclusiveness of VPE programs. Around 80% of students had access to a smartphone or computer with internet connectivity, which enabled them to attend classes regularly. However, 20% of students faced challenges such as slow internet speed, lack of personal devices, and shared screens among family members. These issues hindered their ability to follow live instructions, submit video assignments, or complete app-based fitness tasks. Teachers expressed concern over these disparities, emphasizing the need for inclusive VPE strategies that account for technological limitations, especially in underprivileged communities. Teachers faced significant instructional challenges in adapting PE curricula for virtual delivery. Approximately 68% reported difficulty in evaluating student performance through digital platforms. In the absence of in-person observation, teachers relied on video submissions, photographs, fitness logs, and reflections. However, the reliability of these assessments was questioned, as some students faked data or used pre-recorded material. Furthermore, teachers found it difficult to correct posture, technique, or form, which are essential elements of physical skill acquisition. Only 30% of teachers received institutional support in the form of digital tools or online teaching workshops, while the majority had to improvise based on self-learning. Another recurring theme was the impact of parental involvement on students' success in virtual PE. Interviews revealed that students who had parental encouragement were more likely to attend classes regularly and complete their tasks on time. In some households, parents even participated in the activities, creating a positive environment for family wellness. On the contrary, students whose parents were disengaged or skeptical about online PE struggled with consistency and seriousness. This finding points to the role of the home environment in supplementing the goals of virtual physical education. The study also assessed the quality of student-teacher interaction during VPE. Only 36% of students felt that they received timely and helpful feedback from their teachers. The lack of direct observation and delayed response through text or email limited the scope of real-time correction. Teachers admitted that managing large virtual classes and multiple

communication platforms (e.g., email, WhatsApp, Google Classroom) made it challenging to respond individually to each student. This lack of personalized guidance further reduced students' interest and sense of accountability in their physical education performance. Students were also asked to express their preference for future formats of physical education. The results showed a strong inclination toward in-person sessions, with 72% of students preferring a return to traditional physical education classes. They missed sports drills, games, peer interactions, and the open environment of playgrounds. About 18% of students advocated for a hybrid model, suggesting that theoretical content such as fitness theory, anatomy, or sports rules could be taught online, while physical practice should remain offline. Only 10% of students preferred continuing with a fully virtual model, mostly due to convenience or social anxiety.

The key quantitative findings from the student survey are summarized in the table below:

Summary of Quantitative Findings (N = 100 Students)



The results highlight a multifaceted picture of virtual physical education during the COVID-19 pandemic. While VPE helped maintain continuity and provided some degree of physical and emotional support to students, it fell short in engagement, interactivity, and assessment accuracy. The majority of students and teachers favored a return to traditional or hybrid formats that combine digital tools with hands-on physical practice for a more holistic approach to physical education in the post-pandemic era.

Discussion

The findings of this study reflect a complex interaction between technological accessibility, student motivation, pedagogical methods, and the overall effectiveness of virtual physical education (VPE). While a significant number of

Students reported moderate levels of physical activity and some emotional benefits from VPE programs, the overall engagement and consistency in participation remained low. These results align with earlier studies (Mohnsen, 2010; Wang & Chen, 2013) that emphasized the limited capacity of virtual platforms to replicate the immersive, kinesthetic, and social experiences essential to physical education. One of the key challenges identified was the lack of real-time feedback and direct supervision, which significantly affected skill development and accountability. Teachers struggled to assess movement accuracy and effort through digital tools, often relying on subjective or incomplete student submissions. This reflects the broader pedagogical limitation of online PE programs, where formative and summative assessments become less reliable without physical interaction. The limited training provided to educators further compounded these challenges, highlighting a systemic unpreparedness for virtual transition in physical education. Another notable aspect was the influence of home environment and parental support. Students with engaged parents performed better in terms of participation and completion of tasks, suggesting that socio-cultural factors play a vital role in virtual learning outcomes. Moreover, the digital divide became evident, as some students lacked adequate space or consistent internet access, further marginalizing already disadvantaged groups. These disparities suggest that while VPE can be a temporary solution, it must be implemented with equity-focused strategies and infrastructural support to be truly effective. The study underlines the necessity of a hybrid model in future physical education programs. While theoretical components and fitness tracking may be conducted online, practical sessions require in-person interaction to ensure skill acquisition, safety, and motivation. Blended learning not only offers flexibility but also preserves the holistic benefits of physical education something that purely digital formats cannot fully deliver. These insights offer a roadmap for educators and policymakers seeking to future-proof physical education curricula.

Conclusion

The findings of this study underscore the transitional nature of Virtual Physical Education (VPE) as an emergency response during the COVID-19 pandemic rather than a long-term replacement for traditional physical education. While VPE successfully maintained a degree of physical activity and emotional support for students during lockdowns, it lacked essential components such as real-time feedback, skill development, and peer interaction that are crucial for holistic physical education. The moderate levels of engagement and motivation reported by students suggest that virtual environments alone are insufficient to sustain active and meaningful participation in physical learning. Technological access played a pivotal role in determining the success of virtual PE classes, with students from better-resourced households showing higher levels of participation. However, even among these students, the absence of proper space, equipment, and direct supervision limited the physical rigor and instructional quality of online sessions. Teachers also faced considerable challenges in adapting to digital tools, assessing performance authentically, and maintaining student accountability, which further compromised the educational outcomes of VPE. Despite these limitations, the experience of virtual PE offered valuable insights into the potential of digital tools for supporting theoretical instruction, fitness tracking, and independent learning. Many students and teachers expressed openness toward hybrid models that blend online theoretical instruction with offline physical activity and games. This hybrid approach could offer flexibility, accessibility, and innovation while preserving the core values of traditional PE. In light of these conclusions, educational policymakers, curriculum designers, and school administrators must consider investing in digital infrastructure, teacher training, and blended learning models that enhance the effectiveness of physical education in the post-pandemic world. The future of PE should not be limited to indoor screen-based workouts but should integrate physical, mental, social, and emotional well-being through interactive and inclusive pedagogical strategies.

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