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CHALLENGES AND EFFECTIVENESS OF ONLINE PHYSICAL EDUCATION: ASSESSING STUDENT ENGAGEMENT, PHYSICAL ACTIVITY, AND LEARNING OUTCOMES

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ABSTRACT

Purpose. The transition to online learning has significantly impacted Physical Education (PE), particularly in motor skill development, physical fitness, and student engagement. This study evaluates the effectiveness of online PE learning among students at SMPN 2 Bontoriro, identifying key challenges and proposing strategies for improvement.
Objectives. The study aims to (1) assess students' perceptions of online PE, (2) analyze the impact of digital infrastructure on learning effectiveness, (3) evaluate students' physical activity levels, and (4) explore the psychological effects of online PE and its influence on student motivation.
Materials and Methods. A quantitative descriptive approach was applied, involving 130 students in grades 7 and 8. Data were collected through a structured questionnaire covering student responses, infrastructure availability, physical activity levels, and psychological well-being. Descriptive statistical analysis was conducted using SPSS to determine key findings' frequency and percentage distribution.
Results. The results show that 36.2% of students found online PE ineffective due to a lack of physical interaction, unstable internet access, and an increased workload. Moreover, 48.5% of students engaged in less than 30 minutes of daily physical activity, below recommended standards. 43.1% of students reported boredom, and 12.3% experienced stress, highlighting the psychological burden of online learning. Additionally, male students were generally more engaged in online PE than female students.
Conclusions. Online PE presents significant limitations in practical skill development, physical activity engagement, and student motivation. To enhance its effectiveness, gamification, hybrid learning models, structured physical activities, and teacher training in digital pedagogy should be implemented. These strategies can help increase engagement, motivation, and overall student well-being in online PE environments.

Keywords: Online Physical Education, Student Engagement, Physical Activity, Digital Learning Challenges, Hybrid Learning Model

INTRODUCTION

The transition to online learning has significantly impacted education, particularly in practical subjects like Physical Education (PE), which heavily relies on physical activity, motor skills development, and real-time teacher-student interaction. During the COVID-19 pandemic, many schools were forced to adopt online learning as a substitute for traditional face-to-face instruction. However, the effectiveness of this transition, especially in PE, remains a subject of debate (Martini et al., 2023). While online learning provided necessary continuity in education, it introduced challenges in maintaining student engagement, ensuring effective skill acquisition, and fostering physical activity participation (Laar et al., 2021). Gender disparities in adapting to online PE formats have been observed, with male students demonstrating improvements in aerobic capacity through virtual training while female students often reported declines in fitness levels (Aowei, 2024; Zhang, 2024). This suggests that individual characteristics, access to resources, and motivation levels influence the effectiveness of online PE. Additionally, the lack of structured physical activities and an inadequate home environment have contributed to the reduced effectiveness of online PE, as students encountered monotony, low engagement, and limited opportunities to practice motor skills (Laar et al., 2021).

Despite these challenges, structured synchronous online PE classes incorporating specific training methodologies, such as Tabata, have shown the potential to enhance students' physical strength (Ahn et al., 2022). These findings suggest that while online PE presents inherent limitations, strategic instructional approaches may improve effectiveness. However, the overall effectiveness of online PE remains contentious, as educators and students frequently report difficulties in achieving comparable outcomes to traditional PE instruction due to the limitations of remote learning (Martini et al., 2023). Therefore, it is essential to examine the effectiveness of online PE to identify best practices, address challenges, and ensure that students' physical development needs are met.

The shift to online learning in PE has brought several challenges, particularly in developing motor skills and maintaining physical engagement. One of the primary issues is the difficulty in delivering hands-on instruction remotely. PE requires direct teacher-student interaction, real-time demonstrations, and immediate feedback to ensure proper movement execution (Paderanga et al., 2023; Poblador & Tagare, 2023). However, in an online setting, teachers struggle to monitor and correct students' movements, reducing the effectiveness of skill acquisition (Tegero, 2021). Another significant problem is the lack of engagement and motivation among students. Research has shown that many students become disengaged

without face-to-face interaction, mainly when the lessons rely heavily on theoretical explanations rather than physical activities (Hashemi, 2021; Martin, 2024).

Furthermore, technical difficulties such as poor internet connectivity, unfamiliarity with digital platforms, and the absence of necessary sports equipment at home exacerbate these issues (Ahn et al., 2022; Elewa & Mohamed, 2022). Teachers also report increased stress and workload, as they must develop innovative teaching strategies while adapting to unfamiliar digital tools (Chew et al., 2023; Li, 2024). To address these challenges, a general solution is to adopt a more structured and interactive approach to online PE instruction. For example, integrating video-based demonstrations, gamification techniques, and synchronous physical activity sessions can enhance engagement and improve learning outcomes (McNeill, 2024; Suriagiri et al., 2022). Additionally, teacher training programs on digital pedagogy can help educators develop effective strategies for online PE delivery, improving student participation and overall learning experiences (Işıkgöz, 2024; Rico et al., 2021).

Several strategies have been proposed to improve the effectiveness of online PE. One approach is to enhance student engagement through interactive digital tools and gamification. Research suggests incorporating real-life challenges, rewards, and competition elements into online PE classes can significantly increase student motivation and participation (Peculea, 2023). Additionally, teacher presence and real-time feedback have been identified as critical factors in fostering a sense of community and belonging, helping to mitigate student disengagement (Shannon & Clarke, 2022). Another potential solution is the structured integration of fitness training programs within online PE curricula. Studies indicate that synchronous classes utilizing Tabata training and High-Intensity Interval Training (HIIT) can effectively maintain or improve students' physical fitness (Lee et al., 2021).

However, the success of these programs depends on student compliance and access to an adequate training environment at home. Moreover, wearable fitness trackers and mobile applications have been explored to monitor student activity levels and provide real-time performance feedback (Atienza, 2024; Lubay et al., 2021). Furthermore, research highlights the role of teacher digital competency in ensuring the effectiveness of online PE instruction. Teachers with higher proficiency in digital tools can create more engaging and interactive learning experiences, positively impacting student outcomes (Cao et al., 2023; Işıkgöz, 2024). Continuous professional development programs focused on digital literacy and online instructional design have been recommended to equip educators with the skills to navigate online teaching effectively (Bentri, 2023; Momdjian, 2024).

The effectiveness of online PE has been widely studied, with mixed findings regarding its success. (Setyoningrum, 2022) noted that while online PE provided a viable alternative during school closures, students struggled with engagement due to the lack of physical interaction and hands-on activities. Similarly, (Siregar, 2023) found that self-regulation was crucial in determining student success in online learning, particularly in subjects like PE that require active participation. Additionally, research by (Zaman, 2021) emphasized the importance of online resources in maintaining student motivation and confidence. However, (Orozco et al., 2023) reported that many instructors faced difficulties adapting traditional PE instruction to online formats, resulting in decreased student performance and participation. The rapid shift to online learning led to inconsistent teaching approaches, contributing to mixed outcomes (Dahal et al., 2022; Fernandez et al., 2022).

Despite these findings, several research gaps remain. First, while studies have explored the impact of digital platforms on online PE, few have examined the long-term effects of online learning on students' physical fitness and motor skill development. Second, limited research has been conducted on the role of hybrid learning combining online and face-to-face instruction as a potential solution for improving PE effectiveness (Andrea, 2023; Simamora, 2021). Lastly, while studies highlight the importance of teacher digital competency, there is a need for further research on targeted training programs that can enhance online PE teaching practices (Cantoral et al., 2023; Işıkgöz, 2024). Although various studies have addressed the effectiveness of online learning in physical education, several research gaps have not been fully addressed. First, most studies have focused more on the academic aspects of online learning and have not comprehensively evaluated its impact on student engagement, physical activity, and psychological well-being. Second, although the online learning model offers flexibility, few studies are still exploring the most effective strategies for increasing student participation in online-based physical education classes. Furthermore, few studies still discuss differences in online learning experiences based on gender factors, especially related to engagement and motivation in virtual physical education.

Based on this gap, this study aims to evaluate the effectiveness of online learning of PJOK at SMPN 2 Bontoriro by examining student perceptions, the influence of digital infrastructure on learning effectiveness, students' physical activity levels, and the psychological impacts caused by online learning of PJOK. The results of this study are expected to provide insight into the challenges and opportunities in implementing PJOK online learning and offer strategies that can increase the effectiveness and engagement of students in digital-based learning. The primary objective of this study is to evaluate the effectiveness of

online PE learning in developing students' motor skills, physical fitness, and overall engagement. Specifically, this research aims to assess students' perceptions of online PE and identify factors influencing their engagement and motivation. It also seeks to investigate the impact of digital tools and interactive strategies on the effectiveness of online PE instruction. Furthermore, this study explores educators' challenges in delivering PE online and examines potential solutions to improve instructional practices. Lastly, it aims to determine the feasibility of hybrid learning models as an alternative to fully online PE instruction.

This study uniquely examines online PE effectiveness from multiple perspectives—students, teachers, and instructional methods. While previous studies have explored online learning challenges, this research integrates findings on digital competency, engagement strategies, and hybrid learning models to provide a more comprehensive analysis. Additionally, this study seeks to bridge the research gap on gender differences in online PE participation and long-term fitness outcomes, which remains underexplored (Aowei, 2024; Zhang, 2024).

This study focuses on secondary school students engaged in online PE courses during and after the COVID-19 pandemic. It employs a mixed-methods approach, combining surveys and interviews with students and educators to gain insights into their experiences with online PE. The study also includes a comparative analysis of various digital learning tools and instructional techniques to determine best practices for enhancing online PE effectiveness. This research aims to provide valuable insights for educators, policymakers, and curriculum developers seeking to optimize online PE instruction and improve student outcomes by addressing these objectives.

METHOD

Study Participants

This study aimed to evaluate the effectiveness of online learning in Physical Education (PE) at SMPN 2 Bontoriro during the COVID-19 pandemic. The study population included all 7th and 8th-grade students, with 130 participants. The sampling technique employed was total sampling, where every student in the target population was included in the study (Besekar, 2024). Although total sampling allows for a comprehensive dataset, previous studies indicate that it can pose logistical challenges, particularly for larger populations (Besekar, 2024). However, due to the manageable number of students at SMPN 2 Bontoriro, this technique was deemed appropriate for obtaining accurate insights into students' experiences with online PE.

Table 1. Distribution of Study Participants

Grade Level	Number of Students
7th Grade	61
8th Grade	69
Total	**130**

Research Procedure and Instrument

This study utilized a quantitative descriptive research design, which is well-suited for analyzing student perceptions and learning effectiveness (Haryono & Adam, 2021). This method allows for the systematic collection and numerical analysis of data, providing insights into trends and patterns without experimental manipulation (Korkmaz, 2022). The primary research instrument was a structured questionnaire based on three key indicators of online PE effectiveness: student responses, infrastructure availability, and student activity levels. The questionnaire was adapted from a validated instrument in a prior study on online PE effectiveness in junior high schools (Alfarisyi & Mahardika, 2021). Aiken's V formula was applied to ensure the validity of the questionnaire (Azwar, 2016). Two experts in Physical Education and Sports Science (holding Doctorate degrees) assessed the instrument, confirming its suitability for measuring students' online PE experiences.

Table 2. Validation of research instrument content using Aiken's V Formula

Expert	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Sk	Sk	Sk	Sk	Sk	Sk	Sk	Sk	Sk	Sk	Sk	Sk	Sk	Sk	Sk
1	4	4	4	4	4	3	4	4	4	3	3	4	4	4	3
2	4	4	4	4	4	4	4	3	4	4	4	4	3	4	4
∑s	**6**	**6**	**6**	**6**	**6**	**5**	**6**	**5**	**6**	**5**	**5**	**6**	**5**	**6**	**5**
v	1	1	1	1	1	0.83	1	0.83	1	0.83	0.83	1	0.83	1	0.83
Exp	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**	**Vld**

The questionnaire was distributed via Google Forms, a widely recognized digital tool for online surveys that enhances efficiency and minimizes data entry errors (Pavić et al., 2022). Google Forms was chosen due to its user-friendly interface and ability to compile real-time responses (Çetinkaya, 2024).

Table 3. Questionnaire Indicators and Sample Questions

Indicator	Sample Questions
Student Response	How easy is it to understand PE material in online classes?
	How beneficial is online PE for physical fitness?
	How effective is online PE during the pandemic?
Infrastructure	What type of internet connection do you use during online PE?
	How strong is the internet signal in your area?
	What challenges do you face in online PE?
	Which online platform do you prefer for PE learning?
Student Activity	How much physical activity do you engage in daily during online PE?
	How prepared are you for online PE?
	How often do you attend online PE classes?
	How frequently do you complete PE assignments?
	How actively do you respond to teacher questions?
	How attentive are you during online PE sessions?
	Do you experience any physical discomfort during online PE?
	Do you experience any psychological stress during online PE?

Study Organization

The study was conducted at SMPN 2 Bontoriro in Mataram, West Nusa Tenggara. Data collection took place over one day, ensuring all participants could complete the survey within a controlled timeframe. The research began with obtaining approval from the school administration and coordinating with PE teachers to facilitate student participation. The questionnaire was then distributed through class WhatsApp groups, allowing students to access and complete it conveniently using their smartphones, tablets, or computers. Responses were automatically recorded in Google Forms, streamlining the data collection process. To ensure the validity and clarity of the questionnaire, a pilot test was conducted with a small subset of students before full implementation, following best practices for online surveys (Hirao et al., 2021). This preliminary test helped refine the instructions and survey format, minimizing response bias (Kolly-Shamne, 2022) . After data collection, responses were reviewed to ensure completeness and accuracy before proceeding to analysis. This structured approach ensured that the study was conducted efficiently while maintaining the reliability and validity of the collected data.

Statistical analysis

The collected data were analyzed using descriptive statistics, a widely used method in educational research for summarizing numerical findings effectively (Mallillin et al., 2023). Descriptive analysis was chosen as it provides a clear snapshot of students' experiences and

allows for identifying patterns in engagement, learning effectiveness, and challenges in online PE (Korkmaz, 2022). The analysis process began with verifying the completeness and accuracy of responses before inputting them into the Statistical Package for the Social Sciences (SPSS), which facilitates frequency distributions, mean scores, and standard deviation calculations (Murana & Rahimin, 2021).

Student responses were then categorized into five levels of effectiveness based on their Likert-scale ratings, as outlined in Table 3, which defines the score ranges for determining whether students found online PE very practical, effective, moderately effective, less effective, or ineffective. The findings were then visualized using tables and histograms, which enhanced the interpretation and communication of key insights (Prayitno et al., 2021). A Likert scale analysis was applied to quantify student attitudes toward online PE, which has been widely recognized as a reliable method for assessing engagement and learning satisfaction (Radia & Wulandari, 2021; Waheed et al., 2021). Additionally, the study employed mean, standard deviation, and frequency distribution to examine variations in student perceptions and learning outcomes (Wardana, 2023). This structured statistical approach provided empirical evidence on the overall effectiveness of online PE learning, ensuring that the findings could be used to inform educators, policymakers, and school administrators about best practices for improving digital-based PE instruction.

Table 4. Categorization of Online PE Effectiveness

Category	Score Range
Very Effective	> 52.23
Effective	46.24 – 52.23
Moderately Effective	40.24 – 46.24
Less Effective	34.25 – 40.24
Not Effective	< 34.25

Descriptive statistics were complemented by Likert scale analysis to quantify students' attitudes toward online PE (Waheed et al., 2021). This method has been widely used in educational research to assess engagement levels and student satisfaction with learning formats (Radia & Wulandari, 2021).

Conclusion of Methodology

This study employed a descriptive quantitative approach to analyze the effectiveness of online PE learning at SMPN 2 Bontoriro. Using 130 students as total sampling, data were collected through Google Forms-based surveys, covering three key indicators: student responses, infrastructure, and activity levels. The SPSS software was used for descriptive

statistical analysis, categorizing responses into different effectiveness levels. Tables and histograms were utilized for clear data visualization, ensuring findings were quickly interpretable. This study aimed to provide empirical insights into how online PE impacts student learning and engagement by employing valid and reliable research methods. These findings are expected to guide educators, school administrators, and policymakers in developing strategies to enhance the effectiveness of digital-based PE instruction in future online or hybrid learning settings.

RESULT

The study results on the effectiveness of online learning in physical education, sports, and health subjects at SMPN 2 Bontoriro.

Table 4. Effectiveness of Online PE Learning According to Student Responses

Effectiveness Category	Number of Students	Percentage (%)
Very Effective	23	17.7
Effective	35	26.9
Less Effective	47	36.2
Not Effective	11	8.5

The results indicate that the majority of students perceive online PE learning as less effective, with 47 students (36.2%) rating it as "Less Effective" and 11 students (8.5%) considering it "Not Effective." Meanwhile, only 23 students (17.7%) found online PE to be "Very Effective," and 35 students (26.9%) rated it as "Effective." These findings suggest that while some students could adapt to online PE, a significant portion struggled due to limited physical activity, reduced teacher interaction, and difficulty understanding the material.

Table 5. Students' Level of Understanding of PE Material in Online Learning

Level of Understanding	Number of Students	Percentage (%)
Very Easy to Understand	25	19.2
Easy to Understand	46	35.4
Difficult to Understand	44	33.8
Very Difficult to Understand	15	11.5

The data shows that only 54.6% of students found the material easy or very easy to understand, while 45.3% struggled with comprehension. Specifically, 46 students (35.4%) reported finding the material easy to understand, while only 25 (19.2%) found it easy. Conversely, 44 students (33.8%) stated that they found the material challenging to understand, and 15 (11.5%) found it difficult. These findings suggest that many students faced challenges in grasping PE concepts through online learning, likely due to the lack of direct teacher guidance, reduced physical demonstrations, and limited engagement in practical activities.

Table 6. Type of Internet Access Used by Students

Type of Internet Access	Number of Students	Percentage (%)
Mobile Data (Quota)	50	38.5
Wi-Fi	80	61.5

The majority of students (80 students or 61.5%) rely on Wi-Fi for online learning, while a significant portion (50 students or 38.5%) depend on mobile data (quota). This suggests that although most students have access to a more stable internet connection through Wi-Fi, many still rely on mobile data, which can be affected by limited data plans, fluctuating network coverage, and higher costs.

Table 7. Internet Signal Strength During Online Learning

Signal Strength	Number of Students	Percentage (%)
Strong	36	27.7
Moderate	65	50
Weak	29	22.3

Despite internet availability, signal strength remains a challenge, with 65 students (50.0%) experiencing moderate connection quality, 29 students (22.3%) struggling with weak signals, and only 36 students (27.7%) having a strong connection. These results highlight the potential barriers to effective online learning, as unstable internet connections may impact students' ability to participate in live sessions, watch instructional videos, and complete assignments efficiently.

Table 8. Challenges in Online PE Learning

Challenges in Online Learning	Number of Students	Percentage (%)
Increased number of assignments	51	39.2
Unstable internet connection	42	32.3
Limited internet quota	25	19.2
Difficulty using online learning platforms	12	9.2

The data shows that the most frequently reported challenge is the increased number of assignments, with 51 students (39.2%) finding it overwhelming. Unstable internet connections also significantly impact learning, as reported by 42 students (32.3%). Additionally, the limited internet quota poses a challenge for 25 students (19.2%), making it difficult for them to attend virtual classes and access learning materials. Lastly, 12 students (9.2%) struggle to navigate online learning platforms, indicating a need for better training and user-friendly platforms.

Table 9. Duration of Students' Physical Activity per Day During Online Learning

Duration of Physical Activity	Number of Students	Percentage (%)
No Physical Activity	25	19.2
0 - 30 Minutes	63	48.5
More than 30 Minutes	42	32.3

One of the main drawbacks of online learning is the decline in students' physical activity levels. The study results indicate that 25 students (19.2%) did not engage in physical activity during online learning, while 63 students (48.5%) exercised for only 0–30 minutes per day. Only 42 students (32.3%) engaged in physical activity for more than 30 minutes daily, which is still below the recommended standards for maintaining physical fitness.

Table 10. Psychological Impact on Students During Online Learning

Psychological Impact	Number of Students	Percentage (%)
No Complaints	40	30.8
Stress	16	12.3
Boredom	60	43.1

In addition to its effects on physical fitness, online learning has also impacted students' psychological well-being. The study results indicate that 60 students (43.1%) reported feeling bored, while 16 (12.3%) experienced stress due to online learning. However, 40 students (30.8%) stated they did not experience any psychological complaints, suggesting that some students could adapt well to the online learning environment.

DISCUSSION

The effectiveness of online learning in Physical Education (PE) has been widely debated, particularly during the COVID-19 pandemic. While online PE provides flexibility and accessibility, research suggests it struggles to replicate the hands-on, practical experiences fundamental to PE instruction (Widiastuti, 2023). The findings of this study indicate that most students found online PE less effective than traditional face-to-face instruction, with limited engagement in physical activities and challenges in motor skill development. (Laar et al., 2021) highlight that students frequently experience monotony and a lack of structured activities in online PE, negatively affecting engagement and learning outcomes. Similarly, (Killian & Woods, 2021) emphasize that online learning presents challenges in the psychomotor learning domain, making it difficult for students to develop and refine physical skills. Additionally, motivation levels tend to decrease in online PE classes (Escomes et al., 2021), further impacting student participation. While online PE offers some advantages, such as flexibility in scheduling and access to digital resources, the findings suggest that it cannot fully replicate the experiential learning provided by traditional PE. Therefore, effective instructional strategies

and technology integration are necessary to enhance engagement and learning outcomes in online PE environments.

Student perceptions of online PE learning reveal a complex balance between flexibility, engagement, and motivation. Many students prefer traditional face-to-face instruction, citing difficulties in understanding course materials due to limited interaction with teachers and peers (Afzal et al., 2022; Yan & Syahrunnisa, 2022). The absence of direct teacher feedback and peer interaction contributes to isolation, leading to lower motivation and focus in online classes (Gimpel, 2022; Yan & Syahrunnisa, 2022). Conversely, some students appreciate online PE's flexibility, allowing them to manage their time more effectively and access learning materials at their convenience (Khalid et al., 2021; Wahidah et al., 2022). However, while online learning offers accessibility, it often lacks the interactive and practical experiences essential for skill development and motivation (Killian & Woods, 2021; Kucera et al., 2022). The findings suggest that while some students can adapt to online PE, many struggle with engagement and comprehension, indicating the need for more interactive and structured online PE models.

Infrastructure-related challenges, particularly internet connectivity, digital tools, and accessibility, significantly impact the effectiveness of online PE learning. Many students, especially those in developing regions, struggle with poor internet quality and power outages, which limit their ability to participate in online classes (Magar & Rana, 2022). Additionally, the lack of access to appropriate digital tools worsens the situation. (Zulfqar et al., 2023) highlight that insufficient technological resources prevent students from fully engaging with PE course materials. Similarly, (Wang et al., 2022) emphasize that many students lack reliable internet access and necessary equipment, directly affecting their learning outcomes. These findings indicate that addressing infrastructure challenges is crucial to ensuring equitable access to quality online PE instruction. Investment in digital infrastructure, subsidized internet access, and training programs can help mitigate these barriers and enhance students' learning experiences.

A primary concern in online PE learning is the significant decline in students' physical activity levels, negatively impacting their physical fitness and motor skill development. Research by (Chu & Li, 2022) indicates that university students experienced a substantial dropin physical activity during online learning, leading to adverse health effects. Similarly, (Dergham et al., 2023) highlight that extended screen time and sedentary behavior contribute to obesity and reduced cardiovascular fitness. The lack of structured physical activities in online PE classes also affects students' psychological well-being (Laar et al., 2021). (Haddad, 2024) suggests integrating structured physical activities into online curricula could help

address this issue, promoting physical and cognitive development. The findings emphasize the importance of reintroducing active learning components into online PE, such as guided exercise sessions, gamified fitness challenges, and interactive workout plans, to ensure students maintain adequate physical activity levels.

The shift to online PE has exacerbated psychological challenges among students, including increased stress, boredom, and lack of motivation. Many students report heightened stress levels due to isolation and limited interaction with teachers and peers, which are essential for physical activity engagement (Akram, 2024). Additionally, boredom is prevalent, as online PE often lacks the excitement and dynamic nature of traditional in-person PE (Barlizo & Osorno, 2022). Moreover, intrinsic motivation is difficult to sustain in online settings. (Mikhaylova, 2023) notes that maintaining motivation is critical for student learning outcomes, yet many students struggle to find personal interest in online PE. Similarly, (Akram, 2024) highlights that the absence of strong teacher-student relationships in virtual learning environments negatively affects motivation and engagement. These findings suggest the need for more engaging, interactive, and socially connected online PE strategies, such as virtual team-based activities, live coaching, and peer collaboration, to improve student motivation and psychological well-being.

Teachers and parents have different perspectives on the effectiveness of online PE. Educators often express concerns about the limitations of online platforms in delivering hands-on instruction, which is crucial for skill development in PE (Tian, 2024). Many teachers struggle with adapting traditional PE lessons to virtual settings, reducing the overall quality of instruction (Coulter et al., 2021). On the other hand, parents acknowledge the challenges and benefits of online PE. They appreciate the flexibility of home-based learning (Fitriyani et al., 2022) but express concerns about their children's motivation and engagement levels (Gu, 2022). Parental support is crucial in encouraging students to participate in physical activities, suggesting that stronger collaboration between teachers and parents can improve students' online PE experiences (Coulter et al., 2021; Kääpä et al., 2022).

Gender differences in adaptation to online PE highlight engagement and participation levels variations. Research indicates that male students are more physically active and engaged in online PE than female students (Frikha, 2024). This is mainly due to traditional gender norms, which encourage higher participation in competitive and vigorous activities among males. Conversely, female students face additional challenges, including higher stress and anxiety levels related to online learning environments (Buchan, 2024). Additionally, females prefer individual, non-competitive activities, which may not be as effectively facilitated in

online PE as team-oriented activities that appeal to male students (Buchan, 2024). To ensure equitable participation in online PE, schools and educators should consider gender-sensitive strategies, such as customized workout plans, inclusive fitness programs, and alternative activity choices to cater to diverse preferences.

Although this study provides valuable insights into the effectiveness of online learning in PE subjects, several limitations must be considered. First, the data collection method using a questionnaire can cause bias in responses, such as social desirability bias, where respondents may provide answers that are considered better or by the researcher's expectations rather than answers that reflect their actual experiences. In addition, the possibility of errors in interpreting questions can also affect the validity of the data collected. In addition, this study was conducted in one school, SMPN 2 Bontotiro, which has specific characteristics regarding digital infrastructure and students' socio-economic conditions. Therefore, the results of this study may not be fully generalizable to a broader population, especially for schools with different situations. Further studies with a larger sample size and involving various school backgrounds will be needed to increase the generalizability of the results of this study. Furthermore, this study used a quantitative descriptive design that focused on students' perceptions without conducting a longitudinal analysis of changes in physical activity or student engagement in the long term. Future studies may consider combining qualitative and quantitative approaches and data monitoring over a more extended period to understand the impact of online learning on PE in more depth.

CONCLUSIONS

The findings of this study indicate that while online Physical Education (PE) provides flexibility and accessibility, it remains less effective in delivering practical, hands-on learning experiences essential for motor skill development and physical fitness. Many students struggled with engagement, motivation, and understanding course materials, primarily due to limited interaction with teachers, insufficient physical activity, and infrastructural challenges such as poor internet connectivity and inadequate digital tools. Additionally, the psychological impact of online PE was evident, with many students experiencing boredom, stress, and reduced motivation, further hindering their participation. These findings align with previous research, highlighting that online PE, in its current format, fails to replicate the experiential learning benefits of traditional face-to-face instruction. In addition, PE teachers must improve their digital pedagogy competence to utilize technology to monitor students better and provide online feedback on students' physical activities. Special training on using digital devices in PE learning can be an effective solution in this context. Furthermore,

parental involvement also plays a vital role in supporting students' physical activities at home. Teachers can guide parents on how to accompany their children in physical activities so that they remain active even though learning is done online.

To enhance the effectiveness of online PE, several recommendations should be considered. First, integrating gamification and interactive digital tools can improve engagement by making lessons more dynamic and enjoyable. Second, implementing a hybrid learning model, combining online and in-person instruction, would allow students to engage in theoretical and practical learning experiences. Third, structured physical activity programs should be incorporated into online PE curricula to ensure students maintain adequate fitness levels. Furthermore, enhanced teacher training in digital pedagogy is essential to improve instructional quality and student engagement. Finally, increased parental involvement and collaboration with educators can help create a supportive learning environment that encourages physical activity at home. By adopting these strategies, online PE can become more effective, ensuring that students continue to develop essential physical and motor skills while maintaining their overall health and well-being.

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