Barriers to ICT Integration in Elementary Physical Education: Evidence from Tual City, Maluku Province

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Article Info	Abstract
	The difference in the use of Information and Communication Technology (ICT) between the 3T (frontier, outermost, and disadvantaged) regions poses an enormous challenge towards achieving equitable quality education, particularly in practice-based Physical Education (PJ) subjects. Remote island districts such as Tual City, Maluku Province, face severe issues regarding infrastructure, internet access, and teacher professional development. The aim of this study is to study the integration of ICT and identify the challenges faced by elementary school distance learning teachers in Tual City. Descriptive qualitative research was conducted, data collected through class observations, semi-structured interviews, and documentation of 13 distance learning teachers. The results revealed that 69.2% of the participants had a good idea of ICT, while 30.8% of them had limited knowledge. Although all the participants agreed that ICT can be utilized in learning, a significant disparity was found between classroom practice and self-reported use. Instructional videos, laptops, and PowerPoint were quoted most often, but actual implementation is still in its infancy. Significant obstacles are internal in nature such as low digital literacy and teacher motivation and external such as poor policy support, limited school infrastructure, and poor internet connectivity. The study recommends context-specific ICT education, constructing digital infrastructure, and adaptive policy to support teachers in remote areas. The study contributes theoretically by identifying the application of ICT in less researched practice-based fields, and contributes to policy for the promotion of technology implementation in 3T (third-to-third) territories.

INTRODUCTION

One of the central challenges in advancing educational equity in Indonesia lies in the limited integration of Information and Communication Technology (ICT) in learning processes across frontier, outermost, and underdeveloped (3T) regions. This issue is particularly evident in Physical Education, a subject that requires contextual, activity-based instruction, which complicates the adoption of digital tools. While ICT has been widely applied in general education settings, there remains a noticeable lack of studies exploring its implementation in physical education instruction within archipelagic and rural contexts. This research gap restricts the development of effective strategies and policies to improve ICT-based physical education learning in geographically disadvantaged areas. In education, ICT encompasses hardware such as computers, tablets, and

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phones, as well as software like training and management systems, and communication networks like the intranet and the internet, all of which contribute to enhanced learning and teaching processes. ICT is usually split into two broader functions. First, it facilitates the delivery of instruction and training through communication media that offer teacher-pupil interaction. Second, it aids in learning by promoting interactive environments and greater access to instructional content (Elmi et al., 2024; Prensky, 2001).

Evidence suggests that ICT enhances teaching effectiveness and facilitates higher accessibility, interactivity, and personalization, extending beyond the confines of conventional pedagogy. In particular, it facilitates personalized and dynamic learning and collaborative engagement of learners from diverse geographical locations (Karpliuk et al., 2024; Kumar, 2023). These affordances contribute to the re-structuring of the process of learning and the development of students' digital competences (Prensky, 2001). Certain existing research has pointed to the rich benefits of integrating Information and Communication Technology (ICT) in pedagogic practice, both for core subjects and physical education. Volcu & Volcu (2024) assert that ICT is not merely necessary for greater access to information but also for enabling student-centered learning, differentiated instruction, and the necessity of digital literacy among teachers and students. Therefore, ICT integration is viewed as a crucial component of education today. Likewise,

Karpliuk et al.,(2024) reveals that the application of ICT enhances intellectual activity among children, develops self-regulation, stimulates imagination, and facilitates individualized learning based on the needs of individual learners. Modeling and educational games dealing with ICT profoundly influence the thinking, attention, understanding, and memorization of students. Further, Quaresma (2024) and Taskirova et al. (2024) explain that ICT affects the independent acquisition of knowledge and development of intellectual and creative skills among learners. It also improves learning experiences by promoting effective communication and collaborative learning. In elementary education, or physical education (PE), to be specific, ICT is a must. With the use of the newest technology, teachers can deliver instructional materials more interactively and engagingly, and this enhances student motivation and performance.

While ICT has various advantages in education, such as providing visual and interactive content and enhancing learning resource accessibility (Asfiana, 2024), its use is not unimpeded. Some instructors are faced with teething problems regarding the technology aspect, which is likely to deter the efficient utilisation of ICT in the classroom (Bawa et al., 2024). Furthermore, infrastructural challenges, such as limited internet coverage and poor devices, remain significant drawbacks in rural and remote locations (Dlamini & Vilakati, 2021).

Information and Communication Technology (ICT) in various forms can be employed effectively in physical education, sports, and health teaching. Instructional videos, for instance, help portray complex sporting concepts in engaging and accessible forms (Ji, 2023; Xinxin, 2023) . Web tools such as Google Classroom support the coordination of assignments and classroom communication between teachers and learners (Capel et al., 2020; Lobo, 2023), while hardware such as laptops and tablets enable teachers to offer more interactive and innovative learning experiences (Gensheng & Kelvin, 2022; Xinxin, 2023). Application of these technologies is most effective in primary education when students aged between six and twelve are typically at the concrete operation stage in cognitive development, as proposed by Jean Piaget. This is the age when children begin developing logical reasoning, learning cause-and-effect relationships, and cooperating well with others (Allen & Marotz, 2010). Therefore, integrating ICT into the physical education learning process can enhance motivation and cognitive engagement, helping students grasp concepts more efficiently (Jamun et al., 2023). This strategy aligns with the broader educational goal of overcoming barriers to knowledge transfer and communication between teachers and students, including those related to physical, psychological, socio-cultural, and environmental factors (Widianto, 2021).

Nevertheless, not all educational institutions or educators in Indonesia can effectively integrate ICT, particularly in subjects like physical education. This is especially true in areas classified as 3T, where infrastructure challenges are compounded by the limited availability of competent ICT-skilled educators. Maluku Province, with its vast archipelagic territory of 712,480 km² consisting of 92.4% water and only 7.6% land (Riyadi et al., 2022; Sitaniapessy et al., 2022) and divided into 11 regencies or cities with innumerable island clusters accessible primarily via sea

and, more rarely, by air, exemplifies these challenges. These regencies and provinces were categorized as 3T are frontier, outermost, and underdeveloped regions (MediaCenter, 2022).

Information and Communication Technology (ICT) has been widely recognized as a transformative element in education, particularly in enhancing the effectiveness and efficiency of teaching and learning processes. Recent studies highlight ICT's contribution to promoting student-centered learning, enabling differentiated instruction, and improving the overall quality of education (Volcu & Volcu, 2024; Karpliuk et al., 2024). Within the context of physical education (PE), ICT presents considerable pedagogical potential by offering interactive, engaging, and accessible resources that can support students' understanding of complex physical concepts. Technologies such as learning videos, online tools such as Google Classroom, and multimedia materials facilitate interactive and personalized learning environments (Ji, 2023; Xinxin, 2023). Despite these advantages, the application of ICT in schools in rural and disadvantaged areas remains minimal due to infrastructure constraints and a shortage of proper digital competencies among educators (Dlamini & Vilakati, 2021).

Although a great deal of research has periodically approached the advantages of ICT in general education, there is seemingly still a lack of study on the use of ICT in physical education, particularly in geographically disadvantaged regions such as the city of Tual, Maluku Province. Literature already makes recourse to issues of large subjects in urban areas (Capel et al., 2020; Lobo, 2023) without regarding the particular issues that must be overcome by teachers while imparting ICT-based physical education classes in the archipelago and distant locations. In addition, some studies have yet to explore the challenges being encountered in Indonesia's outer islands, where access to electricity, internet connectivity, and ICT infrastructure remains severely limited (Dlamini & Vilakati, 2021; Ji, 2023). These are added to with an absence of roles played by physical education teachers who are ICT proficient enough, thus hard to implement modern, digital pedagogical methods.

This study is aimed at addressing the said gaps by examining specific barriers to ICT integration in Physical Education learning at the elementary school level in Tual City. The city is composed of 66 small islands, but only 13 of these are inhabited, according to the official tourism website Indonesia–Tourism, which refers to the information as geographical facts of Tual City (Tourism, 2024). Several previous studies have documented similar problems in the Maluku province. Souisa et al. (2020) and Anaktototy et al. (2024) documented that physical constraints are hindering the feasibility of Physical Education teachers to teach lessons in alignment with professional standards. Whereas that, Souisa et al (2020) also stated that limited ICT devices play a significant role in the low usage of technology in the classroom. Besides, Shela Anthonia Lekalaet et al. 2021) stated in their research that low digital literacy among teachers is one of the causes for the decrease in the quality of practical learning in the island region. It has been clearly explained that such obstacles also bring additional weight to the problems faced by practice-based subjects like Physical Education.

Contrary to earlier studies that focused largely on ICT integration in key subjects and urban areas (Capel et al., 2020; Lobo, 2023), this research aims specifically to explore the ICT use barriers in Physical Education teaching in Indonesia's distant island areas, filling an important gap in current research. By focusing on these localized challenges, the present study seeks to contribute novel insights into the real-world limitations faced by physical education educators in 3T (frontier, outermost, and underdeveloped) regions. The findings of this research are expected to provide evidence-based and practical suggestions to enhance the ICT literacy of teachers and the quality of physical education instruction as a whole. Further, the research outputs can be used as a good example by policymakers and stakeholders of education in other remote and archipelagic districts of Maluku Province and other similar regions globally.

METHOD

This research employed a qualitative descriptive approach (Bogdan & Biklen, 1982). Aims to explore the application of Information and Communication Technology (ICT) by Physical Education, Sports, and Health (PE) teachers in primary schools. It was conducted on the basis of physical education teachers' lived experience, perception, and situational reality in Tual Island City. The research procedure was carried out in four subsequent phases: (1) initial conditions mapping, (2) data collection, (3) data analysis, and (4) results interpretation. These stages are illustrated in Figure 1.
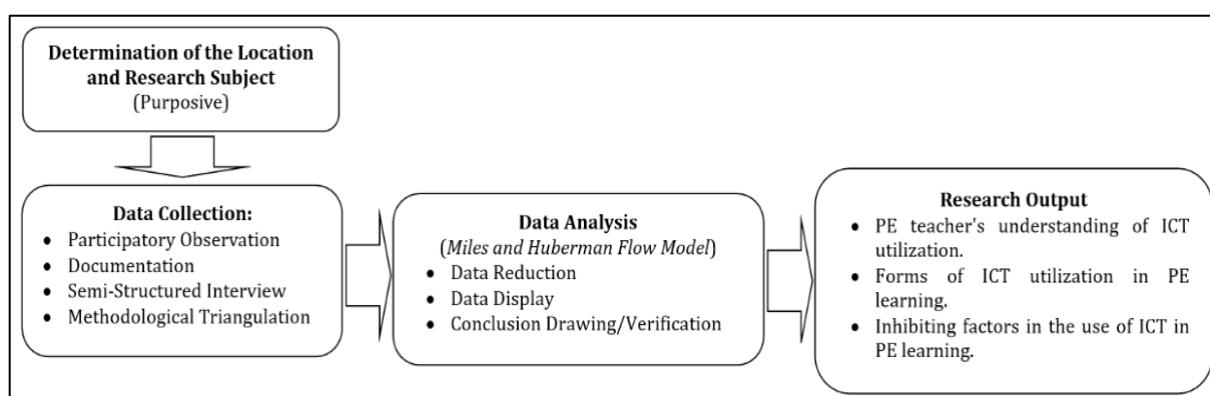

Figure 1. Research Implementation Stages

A total of 13 physical education teachers were selected as participants through purposive sampling. These participants were drawn from 13 different public elementary schools across Tual City. They were selected based on their teaching experience (averaging 10 years), their local knowledge, and their active involvement in physical education instruction. The rationale for this selection lies in the need to obtain rich, contextual data from experienced practitioners who understand the educational and technological landscape of remote island regions. The number of participants is considered representative for qualitative research of this nature, which prioritizes depth of insight over breadth of sampling.

The study employed three data collection techniques: observation, documentation, and semi-structured interviews.

- Observation was conducted using a participant observation model, where the researcher engaged directly in classroom activities to understand how ICT was applied in real-time teaching practices. A structured observation sheet was used to guide and record key aspects of teacher behavior, ICT usage, student engagement, and classroom interaction.

- Documentation included the collection of relevant teaching materials such as lesson plans, learning modules, photographs, and audio-visual recordings. These were used to triangulate observational and interview data.

- Interviews were conducted using a semi-structured guide developed based on the research questions. The instrument included key themes such as: (1) teachers' understanding of ICT; (2) forms and frequency of ICT use in physical education; and (3) barriers to ICT implementation. The guide allowed flexibility to explore emerging issues during the interviews.

In order to ensure the validity of the findings, the research applied methodological triangulation through comparison of information between the three sources (observation, documentation, and interviews). Member checking was also applied to verify the correctness of interpretation with participants. An explanation of the methods of data gathering is provided in Figure 2.
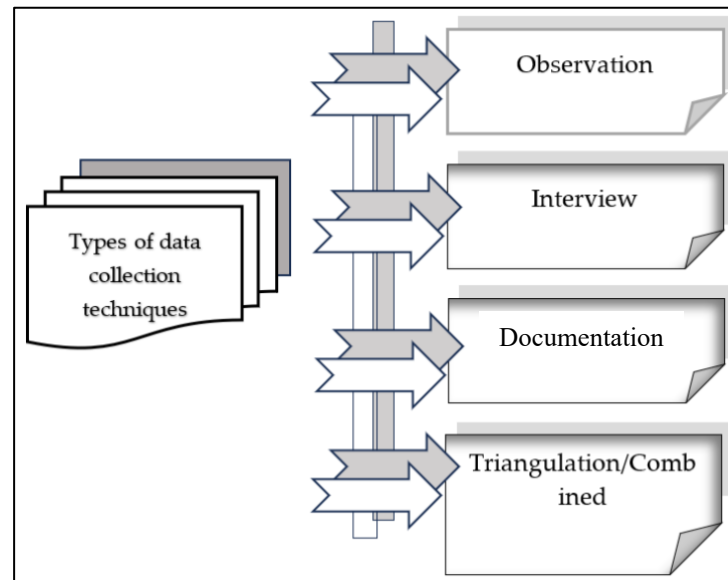
Figure 2. Data Collection Techniques Used in the Study

Data were analyzed following the Miles and Huberman flow model, which has three phases: data reduction, data display, and drawing conclusions or checking (Prastowo & Sandra, 1982; Sugiyono, 2018).

• Under data reduction, all of the field notes, transcripts, and documents were organized and coded within emerging categories.

• Data display was done through narrative summaries, matrices, and diagrams to show patterns and relationships.

• The conclusion-drawing and verification stage involved interpreting the meaning of the results and their verification through triangulation.

This model enabled the researcher to logically identify and delineate three principal components of the research: (1) teachers' conception of ICT use, (2) actual ICT practices in physical education learning, and (3) barriers to effective ICT integration. The flow model of data analysis depicted in Figure 3 illustrates the sequential process through which these components were systematically examined and interpreted.
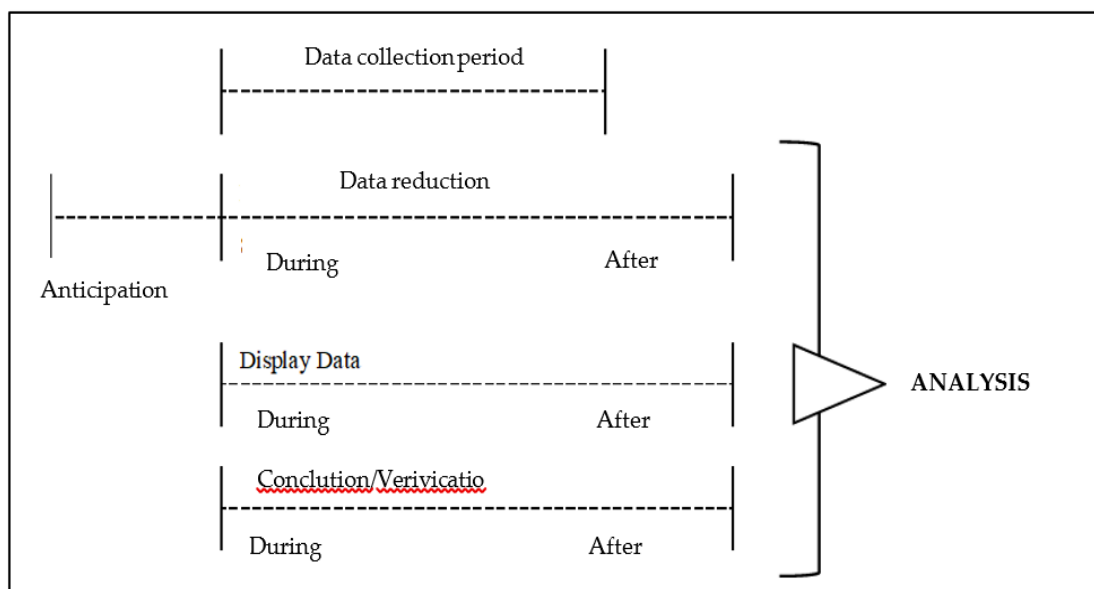

Figure 3. Flow Model of Data Analysis

RESULTS AND DISCUSSION

Results

The findings of this study are derived from data collected through classroom observations, semi-structured interviews, and documentation involving 13 research participants. The data were analyzed based on three primary indicators: participants' understanding of Information and Communication Technology (ICT); the specific forms of ICT integration in Physical Education, Sports, and Health (PE) instruction; and the challenges encountered during the use of ICT in instructional practices.

Understanding of ICT Among Teachers

The first indicator examined participants' basic understanding of ICT. When asked directly, "Do you understand the general concept of ICT?", 69.2% of the respondents indicated understanding, while 30.8% reported they did not. As shown in Figure 4, this reflects a partial level of digital literacy among physical education teachers in Tual.
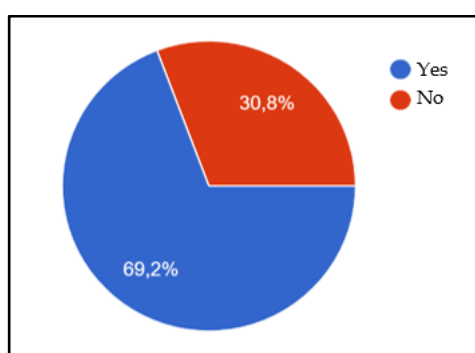

Figure 4. Research Subjects' Understanding of the ICT Concept
Source: Researcher's Analysis, 2025

Forms of ICT Utilization in Physical Education Instruction

The second indicator assessed the extent and nature of ICT use in physical education. All participants (100%) agreed that ICT can be utilized in physical education learning, reflecting a general awareness of the relevance of technology. To verify this, participants identified the ICT tools they used most frequently. The researcher listed commonly used ICT tools: PowerPoint for clarifying material, instructional videos, the internet for sourcing learning content, laptops during theory sessions, Google Forms for evaluation, Google Classroom for assignment sharing, and Android smartphones for instructional support.

Figure 5 illustrates the frequency of ICT usage. Instructional videos were the most frequently used (76.9%), followed by laptops (69.2%) and PowerPoint presentations (46.2%). A smaller percentage of respondents used the internet (46.2%). Meanwhile, the use of Google Forms, Google Classroom, and Android smartphones each stood at 15.4%, indicating these platforms were less integrated into physical education instruction.
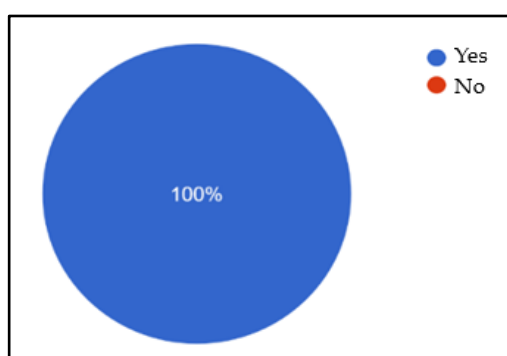

Figure 5. Subjects' Agreement on ICT Utilization in PE Instruction
Source: Researcher's Analysis, 2025

To validate the accuracy of the participants' responses about the first indicator, namely "teachers' understanding of ICT utilization in education," and the second indicator, "the forms of ICT integration in physical education instruction," the researcher presented seven common forms of ICT application that are generally used in classroom instruction and are also frequently applicable in Physical Education, Sports, and Health (PE) teaching contexts. These seven forms include: (1) Using PowerPoint presentations during classroom instruction to clarify teaching materials, (2) Showing instructional videos to students in alignment with the lesson content, (3) Using the internet to explore additional learning materials, (4) Utilizing laptops during theoretical lessons, (5) Employing Google Forms for learning assessments, (6) Using Google Classroom for distributing learning tasks, (7) Using Android smartphones to support instructional activities. Based on these seven ICT application categories, the results from interviews and classroom observations are summarized in Table 1.

Table 1. Forms of ICT Utilization in Physical Education Instruction

ICT Usage Type	Self-Reported Use (%)	Observed Use (%)
Instructional Videos	76.9	15.4
Laptops	69.2	38.5
PowerPoint	46.2	23.1
Internet	46.2	15.4
Google Classroom	15.4	0
Google Forms	15.4	0
Android Smartphones	15.4	0

Based on the participant responses summarized in Table 1, the following details can be described: (1) For the first form, "using PowerPoint in the classroom to clarify learning materials," 46.2% of the participants (six individuals) reported doing so. (2) Regarding the second form, "showing instructional videos relevant to the learning content," 76.9% (nine participants) indicated using videos in their teaching practices. (3) For the third form, "using the internet to explore learning materials," 46.2% (six participants) reported utilizing online resources during instruction. (4) In terms of "using laptops for theoretical lessons," 69.2% (nine participants) stated that they incorporated laptops into their classroom activities. (5) For the fifth form, "using Google Forms for learning assessments," only 15.4% (two participants) reported using this tool. (6) Likewise, for the sixth form, "using Google Classroom to distribute assignments," only 15.4% (two participants) reported using this platform. (7) Lastly, regarding "using Android smartphones for instructional purposes," only 15.4% (two participants) reported regular usage of smartphones in teaching.

These findings reflect a high level of awareness among teachers regarding the potential of ICT in education, but also reveal significant disparities between perceived and actual practice, especially in terms of consistent and pedagogically sound ICT integration in physical education classrooms.

Challenges in ICT Integration

The third indicator focused on challenges teachers faced in utilizing ICT. Participants fell into three categories. First, 7% reported no significant issues, citing comfort and routine in using digital tools. Second, a majority of 77% acknowledged significant obstacles, both internal and external. Third, 16% provided ambiguous responses, suggesting unclear understanding of ICT. Internal challenges included a lack of motivation to explore ICT tools, limited digital skills, and uncertainty about practical ICT use. Externally, participants cited a lack of school-provided ICT infrastructure, poor internet access in remote coastal areas, and the absence of clear school policies supporting ICT integration. Additional constraints included frequent power outages and limited digital skills among students.

Discussion

Information and Communication Technology (ICT) plays a significant role in the educational context, serving not only as a supporting tool but also as a bridge that expands access and enhances interaction between students and teachers. ICT also functions as a medium to clarify various

educational content. The integration of ICT in general learning, including in Physical Education, Sports, and Health (PE), aligns with the advancement of the 4.0 technological era, which has increasingly penetrated the field of education. This development challenges teachers to consciously innovate in creating engaging and motivating learning experiences that foster student participation.

This study aimed to analyze the use of ICT and identify various challenges in physical education learning at the elementary level by teachers in Tual City, Maluku Province. Based on the findings previously presented, it can be concluded that as an administrative city in an archipelagic province, Tual is classified as a 3T area (frontier, outermost, and underdeveloped), characterized by geographical remoteness, limited infrastructure, and inaccessibility. Natural conditions also present major obstacles, making infrastructure development difficult to optimize. These limitations significantly impact educational development.

The results showed that 69.2% of participants understood the concept of using ICT in physical education instruction, while 30.8% did not. While the majority recognized the importance of ICT in physical education pedagogy, there still remains a pool of educators who are not knowledgeable about this. This reflects the need for more inclusive training and outreach activities on ICT adoption in physical education learning. This conforms to the findings of (Irwahand et al., 2022), who found that the majority of physical education teachers do not know about ICT-based teaching practices. Therefore, it is necessary that schools and local education authorities provide help in the shape of seminars or workshops to ensure that teachers understand the benefits and applications of ICT in educational teaching. Similarly, (Ayunar et al., 2024) found that professional development and institutional support are required to improve the ICT skills of public school teachers in Bukidnon, with the recommendation that there should be training programs that will improve technology integration in education.

Concerning the kinds of ICT that are used to instruct physical education, 100% of the teachers supported that ICT can be used within physical education learning, indicating high levels of awareness among instructors. ICT can increase engagement and improve the interactivity of lessons, making the learning experience more dynamic and effective. However, a significant gap was found between teachers' self-reported use and their actual classroom practices, as confirmed by field observations. Table 2 presents a comparative summary of self-reported and observed use of various ICT tools in physical education instruction.

Table 2. Comparison Between Self-Reported and Observed Use of ICT Tools in Physical Education Learning

ICT Tool	Self-Reported Use (%)	Observed Use (%)	Interpretation
Instructional Videos	76.9%	15.4%	High intention but low practice; limited access to devices and preparation
Laptops	69.2%	38.5%	Moderate gap; reflects personal ownership limitations or sharing constraints
PowerPoint	46.2%	23.1%	Indicates low digital literacy; basic tools underutilized
Internet	46.2%	15.4%	Connectivity and power issues hinder effective use
Google Classroom	15.4%	0%	No observed use; requires training and administrative support
Google Form	15.4%	0%	No observed use; potential for digital assessment not yet realized
Android Smartphones	15.4%	0%	Underused despite availability; skills and context barriers persist

As shown in Table 2, although 76.9% of teachers reported using instructional videos, classroom observations revealed that only 15.4% implemented them. This discrepancy illustrates a critical gap between teachers' stated intentions and their practical application in physical education instruction. Interviews revealed contributing factors such as limited access to personal laptops, unfamiliarity with video editing or selection, and shared household use of devices. These findings

support the argument that mere access or awareness is insufficient for integration; digital literacy and contextual support are key (Boruah, 2023; Mahmudah et al., 2022).

Similar gaps were found in the use of laptops and PowerPoint presentations. While most teachers claimed to use laptops (69.2%), classroom observations revealed that only 38.5% did. Likewise, although 46.2% reported using PowerPoint, only 23.1% incorporated it into their lessons. This indicates a broader issue of limited competency and a lack of confidence in using basic educational technologies. These results are in line with the findings of Koshti et al. (2023)and Fathima et al.,(2024) who emphasized the need for foundational ICT training in resource-constrained educational settings. The limited use of ICT tools in physical education instruction is primarily influenced by various challenges. The findings showed that 7% of participants experienced no obstacles, 77% encountered both internal and external challenges, while 16% provided unclear responses.

Internal Factors

Low motivation, lack of digital skills, and discomfort with technology highlight the need for capacity building through continuous training.

External Factors

Inadequate infrastructure, absent equipment, poor internet, and the absence of policy facilitation for ICT integration were significant hindrances. Schools have to bridge these gaps by improving ICT infrastructure and putting in place enabling policies.

Unclear Responses:

Some participants could not clearly articulate their views on ICT, likely due to limited understanding (as reflected in the results section). This points to the need for schools to offer further guidance and mentoring to teachers to learn how to apply ICT in teaching physical education.

These results are also supported by a number of earlier research studies that uncover a chain of ICT-related challenges in education. Anastasopoulou et al. (2024) and Boruah (2023) indicate that a lack of access to information where ICT is not available can be a significant setback to learning and comprehensive knowledge construction. Fathima et al. (2024) and Firdaus & Ritonga (2024) further add that lack of interaction is a critical problem since ICT makes it easier for interaction between teachers and students. Koshti et al. (2023) and Mahmudah et al. (2022) further add that ICT lowers the standards of education because technology makes it easier for more interactive and creative methods.

Moreover, Meriyanti and Jasmina (2022), and Rakshak Bharti et al. (2024) explain that online education is particularly challenging in archipelagic areas due to logistical limitations, thus enhancing education inequality because ICT non-users are left behind. Sambul et al. (2024) continue that a lack of digital literacy negatively impacts students' readiness to work in a technology-driven workforce. Finally, Boruah (2023) adds that poor access to ICT can dampen the students' creativity since information and communications technology facilitates their ability to find and convey ideas better. Zulkifli et al. (2024) also found that improved telecommunications infrastructure, improved digital literacy on the part of the students and teachers, and improved collaboration between the government and the industry are required to address these issues.

Therefore, this study highlights two key takeaways: (1) Failure to integrate ICT in physical education learning, especially in areas like Tual, will have negative consequences for student outcomes. (2) Although national development strategies prioritize infrastructure and human resource development in islands, the reality in Tual's classrooms does not align with these strategies, as major challenges remain unaddressed.

LIMITATIONS

This study encountered several challenges and obstacles that affected the application of ICT in physical education instruction in Tual City, Maluku. First were the infrastructural limitations that were major challenges, such as limited ICT equipment, unreliable internet connections, and

frequent disruptions of technology that were meant to be utilized during learning. Second was the low levels of teachers' skills and competencies in operating ICT tools. Despite the availability of technology, instructors struggled to manage equipment like projectors and laptops, particularly in delivering lessons with multimedia tools. This indicates the need to offer greater training to ensure teachers can utilize technology more efficiently in learning processes. Third, although there were human resource and infrastructure development plans for the archipelagic region, ground implementation lagged in every aspect of these plans. It was hindered by constraints such as limited time for ICT integration into teaching and a lack of support from schools, resulting in technology being poorly utilized in classrooms. Second, there were situations where some of the research participants gave unclear answers, possibly due to a poor grasp of ICT's use in physical education teaching. Third, the country was an archipelago with geographical and social conditions that presented a unique challenge, in which access to proper infrastructure was predominantly limited, and the social environment was not completely favorable to maximizing ICT use.

CONCLUSION

This study offers a significant contribution to the discourse on digital literacy and the integration of Information and Communication Technology (ICT) in Physical Education (PE) within remote and underdeveloped island regions. The findings highlight that the digital divide in education is not solely driven by technological scarcity but is equally shaped by pedagogical, systemic, and geographical barriers. Accordingly, this research expands theoretical insights into ICT integration by focusing on subject-specific contexts, particularly in physical activity-based learning, which remain underrepresented in global literature. From a policy perspective, the study underscores that the effective use of ICT in physical education instruction in island areas such as Tual City will remain limited unless it is accompanied by coordinated, multi-level interventions. Therefore, it is recommended that stakeholders implement sustained digital literacy training, invest in infrastructure adapted to geographic constraints, and establish clear school-based policies that mandate and facilitate ICT use in physical education instruction. Collaborative efforts among government bodies, the private sector, and higher education institutions are crucial to accelerating educational digital transformation in marginalized regions.

Future research should focus on developing context-sensitive ICT training models tailored to physical education instruction in 3T areas. Further studies may also examine the measurable impact of ICT integration on student learning outcomes in cognitive, affective, and psychomotor domains within resource-limited settings. Comparative and interdisciplinary research across regions or school subjects is needed to better understand the diverse dimensions of ICT implementation. A transdisciplinary approach that bridges educational technology, physical education, and public policy could generate innovative strategies to address digital equity challenges in Indonesian education.

AUTHOR CONTRIBUTIONS

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