

UNIVERSITI TEKNOLOGI MARA

**DEVELOPMENT OF DIGITAL
SKILLS QUESTIONNAIRE AMONG
PHYSICAL EDUCATION
TEACHERS IN SELANGOR**

**HASNIDA HANIM BINTI AHMAD
KAMIL**

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HASNIDA HANIM BINTI AHMAD KAMIL

Thesis submitted in fulfilment
of the requirements for the degree of
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CONFIRMATION BY PANEL OF EXAMINERS

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I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

The rapid development of digital technology in this century has significantly influenced various sectors, including education, where technological methods have been widely integrated into teaching and learning at schools. PE teachers play a crucial role in ensuring the effective application of digital technology in teaching and learning processes. This study aims to develop a valid and reliable instrument to assess the digital skills of PE teachers. Additionally, the study attempts to assess and determine the level of digital skills among PE teachers in Selangor. The quantitative study was employed with statistical descriptive and inferential statistics. The mean, CFA, Simple T Test, ANOVA, and MANOVA were employed to analyze the data. The findings reveal the instruments are valid and reliable, and the level of digital skills among the sample was found to be moderately high. Additionally, there were no significant differences in the digital skills levels of PE teachers when analysed across this demographic in Selangor. This indicates a consistent level of digital competency among teachers regardless of their age, geographical location, or gender. The study underscores the importance of considering these factors in formulating government and education policies to enhance the integration of digital technology in PE teaching nationwide. By emphasizing these elements, educational policies can promote equitable access and effective use of digital tools in PE instruction, thus fostering a more inclusive and technologically advanced learning environment across all states.

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LIST OF ABBREVIATIONS

Abbreviations

4IR	4th Industrial Revolution
5IR	5th Industrial Revolution
A	Assessment
AI	Artificial Intelligence
AR	Augmented Reality
AVE	Average Variance Extracted
BBM	Bahan Bantuan Mengajar
BTS	Bartlett's Test of Sphericity
CC	Communication and Collaboration
CDC	Creation of Digital Content
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CK	Content Knowledge
CR	Composite Reliability
CVI	Content Validity Index
DELIMA	Digital Educational Learning Initiative Malaysia
DEP	Digital Education Policy
DIGCOMP	The European Digital Competence Framework for Citizens
DIGCOMP 2.1	Digital Competence Framework 2.1 -Digcomp 2.1

DNB	Digital Nasional Berhad
DOSM	Department of Statistics Malaysia
DR	Digital Resources
EDF	Empirical Distribution Functions – EDF
EFA	Exploratory Factor Analysis
EL	Empowering Learners
EPRD	Division of Education Policy Planning and Research
FERPA	Family Educational Rights and Privacy Act
FLC	Facilitating Learners’ Digital Competence
GC	Guru Cemerlang
GDPR	General Data Protection Regulation
IC3	Internet Crime Complaint Centre
ICT	Information and Communication Technology
IDL	Information and Data Literacy
INTEF	Common Framework for Teaching Digital Competence
IPG	Institute of Teacher Education
IPSIS	Institute of Graduate Education
ISTE	The International Society for Technology in Education
IT	Information Technology
JPN	Jabatan Pendidikan Negeri
KMO	Kaiser-Meyer-Olkin
LAN	Local Area Network

LMS	Learning Management System
M	Mean
MCMC	Malaysian Communications And Multimedia Commission
MOE	Ministry of Education
NEP	National Education Philosophy
PdPc	Pengajaran Dan Permudahcaraan
PE	Physical Education
PE	Professional Engagement
PIAAC	International Adult Competency Assessment Program
PK	Pedagogical Knowledge
RAMSEA	Root Mean Square Error Approximation
SD	Standard Deviation
SDT	Self Determination Theory
SEM	Structural Equation Modeling
SITES	Second Informational Technology in Education Study
SPSS	Statistical Package for The Social Sciences
T&L	Teaching And Learning
TALIS	International Study of Teaching and Learning
TCT	Technology Continuance Theory
TK	Technological Knowledge
TLA	Teaching, Learning and Assessment
TPACK	Technological Pedagogical Content Knowledge

TVE	Total Variance Explained
UiTM	Universiti Teknologi Mara
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPSI	Universiti Pendidikan Sultan Idris
VR	Virtual Reality
WEF	World Economic Forum
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

The world today has moved towards digitalization, where technology is used in many aspects of life, including education and work. If Artificial Intelligence (AI) and other emerging technologies were to be adopted, 42 percent of tasks would be automated (Yadav et al., 2023). The education system is also going digital, with technology used in teaching and learning across schools, colleges, and universities. The teaching and learning processes are those in which teachers transfer knowledge to students. It is this word that describes the totality of the process by which a teacher decides and implements the learning objectives, designs the teaching resources, and determines the teaching and learning methodology. Therefore, in the current educational environment, technology tools such as smartphones, tablets, laptops, smart boards, simulations, dynamic visualizations, and virtual laboratories are being widely adopted across the educational system for teaching and learning (Haleem et al., 2022). As such, it becomes an essential complement to the teaching and learning process in the education context.

The COVID-19 pandemic has changed the world's education landscape. To sustain the teaching and learning process, teachers, educators, and students must adapt to the use of technology, which provides unlimited access to information (UNESCO, 2020). At least one-third of students worldwide have been affected by the lack of ICT infrastructure and digital learning resources in their countries. As far as that experience is concerned, digital literacy and digital competencies of the teachers and students are required for the smooth delivery of lessons and ultimately empowering the education system. Therefore, to continue the learning process despite external factors such as the pandemic, teachers should be equipped with strong digital skills to teach their students (Serezhkina, 2021).

National Education Philosophy (NEP) aims to develop the individual's potential in intellect, spirituality, emotion, and physical to produce Malaysian citizens who are knowledgeable, skilled, virtuous, responsible, and capable of achieving personal well-being and contributing to the harmony and prosperity of the family, community, and nation. The Ministry of Education (MOE) has also introduced the Digital Education Policy (DEP) to fulfil the NEP's aspirations, which emphasizes the integration of digital

technology into teaching and learning for students and teachers (Anuar et al., 2019). DEP was a response to the challenges of 5IR, which was an extension of 4IR. It shows how important it is to integrate digital skills into learning, which should be given attention, particularly to teachers who serve as facilitators in the learning process.

PE teachers are responsible for ensuring the objectives of NEP are achieved. In this regard, PE teachers are working on the development of three domains: psychomotor, cognitive, and affective. Physical education should promote lifelong fitness, improve mental well-being, foster a healthy-conscious community and environment, and support students' physical and cognitive development (Ghani et al., 2015; Murid et al., 2023; A. F. A. Rahman et al., 2021). However, the increasing pace of technology and digitization has also made PE teachers face some challenges while teaching PE subjects, and they must make sure that the PE subjects can fulfil the needs of the three domains (psychomotor, cognitive, and affective). Physical education is delivered face-to-face by nature, as it requires a range of motor skills and movement in teaching and learning (Özkara & Kalkavan, 2021). Physical education teachers can also use different teaching techniques to teach students in various ways; for example, in football, students need to dribble; in netball, they need shooting skills; and in badminton, they need footwork skills. According to Kim et al. (2021), physical education subjects are physical activity and fitness subjects that require students to engage in and practice their movement and motor skills.

In this regard, PE is interactive, focusing on hands-on instruction, including demonstrations, presentations, group activities, and standardized practice (Chu et al., 2022). PE teachers should adapt to the latest technology in managing PE subjects, as technological development and digitization are part of future education. In this regard, the level of digital skills among PE teachers should be increased so they can adapt current educational development to PE subjects.

The aim of this study is to develop a research instrument for measuring digital skills among PE teachers. The researcher will develop and adapt a new instrument catered to Malaysian PE teachers to improve their digital skills and guide digital integration in teaching PE.

1.1 Background of the study

Technology plays an important role in today's education transformation. It has helped reshape teaching methodologies in today's digitally driven era. It is acknowledged that the use of technology can enhance students' engagement and help teachers cater to their diverse learning needs. Thus, teachers must be digitally competent so that they can use learning management systems, design multimedia resources, and utilise interactive teaching strategies. Digital skills help support teachers in integrating technology into teaching. In this context, digital skills include the ability to access, evaluate, create, and share digital content using different tools and platforms. Moreover, technology allows teachers to change from traditional teaching practices into more dynamic, learner-centred approaches that focus on critical thinking, creativity, and collaboration. The use of interactive applications, digital simulations, and gamified learning environments is one example of digital integration in learning. This can increase interactivity, leading to more active participation and engagement from students.

Technology helps provide more personalized learning experiences to students with diverse needs. Data-driven information and adaptive technologies are used to identify students' learning needs and enrich learning activities with interactive instructional content and feedback to support continuous improvement. Technology also allows adaptability to make traditional classrooms more inclusive for students with diverse abilities, backgrounds, and experience in using technology.

Digital skills is an essential component of professional competence in line with the shift toward blended and hybrid learning models so that teachers can innovate, collaborate, and provide high-quality education. While it is common for digital learning to be used in teaching of mathematics and science where teachers tend to use digital tools and simulations, virtual labs and digital problem solving. The integration of PE and technology is still scarce. As PE is large associated to physical activities, kinesthetics skills. hands-on learning and classes are usually conducted outside of the classroom, there is still a lack of facilities to accommodate digital integration in PE teaching.

Undoubtedly, digital technology use in teaching PE can change how the subject is being taught and how students interact with teachers and among themselves. This shows the importance of equipping PE teachers with digital skills. These skills can help

them use information technology to improve their lessons, assessment, and classroom management. Teachers can use technology like learning management software and interactive digital tools to plan lessons that are engaging, and provide meaningful learning experiences (Zhao, Chen, Yang, & Su, 2025).

Digital learning is known to benefit both teachers and students. Thus, PE teachers should acquire strong digital skills so that they can shift from traditional PE instruction to a interactive lessons. In this light, the use digital applications like video analysis and virtual learning platforms, can help PE teachers conduct more interactive lessons to increase engagement among digital-native students. This integration is in line with the educational goals of Society 5.0 where aspects like multiple literacies, as well as cognitive, motor, social, and digital competencies are highly prioritized. (Wicaksono-Ikhsan & Suherman-Wawan, 2023). At the same time, teachers are facing many constraints in technology. It was reported that many teachers have limited access to technological resources. They also have no training and professional development on digital skills, causing them to lag behind and not knowledgeable on technological advances. The above statement highlights the importance of addressing challenges in digital integration. It can help maximize the benefits of digital skills in PE and increase students interest in physical activities through PE (Zhao et al., 2025; Wicaksono-Ikhsan & Suherman-Wawan, 2023).

Many PE teachers have difficulties in using technology effectively. One reason of this is that they lack training, have limited access to digital resources, and have low self-efficacy in using technology (Rojo-Ramos et al., 2020). Teachers hardly use tools like fitness applications (e.g., Sworkit Kids, Nike Training Club), video feedback systems (e.g., Hudl Technique, Coach's Eye), and motion tracking technologies (e.g., MyJump2, Polar Team Pro), despite these devices having significant pedagogical value in physical education and can help increase engagement, improve performance analysis, and support differentiated instruction. Teachers are still lack training and access to facilities that allow them to use these devices. There is also no subject-specific digital integration strategies guiding the use of devices in PE. Frameworks like Technological Pedagogical Content Knowledge (TPACK) (Mishra & Koehler, 2006) can provide conceptual guidance to help teachers integrating technology in classroom. studies found that this framework cannot entirely address issues faced in PE teaching and learning. This situation leads to a gap between theory and practice, which prevent meaningful technology integration in PE.

In Asian countries, the integration of digital technology into Physical Education (PE) highlights the complex link between teachers' interest in innovating new pedagogical approaches and the systemic challenges limiting digital integration. Despite teachers' positive attitude towards integrating technology into their teaching practices, they are often faced with limited infrastructure and inner challenges that hinder them from using technology effectively (Ahmad & Rathakrishnan, 2023; Abu Hanifah et al., 2023).

Undoubtedly, there is a need to increase digital skills among PE teachers to ensure meaningful technology integration. As mentioned in the European Commission's DigCompEdu Framework (2019), there are several key domains of digital skills: information and data literacy, communication and collaboration, digital content creation, problem-solving, and ensuring digital safety. They allow teachers to apply digital tools in instructional design, assessment, and student engagement. These advantages show that PE teachers with high digital skills will be more capable of using digital platforms to analyze performance, facilitate interactive learning, and provide personalized feedback, which in turn helps improve teaching effectiveness and student outcomes (Kaur et al., 2022).

Studies have reported inconsistency in the level of digital skills among PE teachers in Asia due to a lack of infrastructure, low access to digital resources, and limited opportunities for targeted professional training (Rashid et al., 2022). It was also found that despite the strong motivation and readiness to adopt technology, teachers often have low digital proficiency. A study in Malaysia found that teachers' enthusiasm for digital transformation is not always supported by institutional readiness (Ahmad & Rathakrishnan, 2023). As a result, digital technology integration in PE is still at a surface level, with training focusing on digital tools rather than pedagogical changes.

The above argument highlights the need for PE teachers to have high digital skills, and digital skills improvement programs should be deemed a strategic educational priority. In this sense, digital skills allow teachers to design more interactive and inclusive learning environments. PE teachers can use gamified platforms (e.g., Kahoot, Quizizz, and Wordwall), wearable fitness trackers, and video-based performance analysis tools to engage students and promote active learning (Ahmad & Rathakrishnan, 2023; Kaur et al., 2022). Thus, digital skills fill the gap between technological enthusiasm and effective classroom implementation and align PE education with the aspiration of 21st-century learning. Digital skills can also help

achieve sustainable digital education transformation and encourage innovation, inclusivity, and lifelong learning.

Belisario's (2023) study in the Philippines identified a profound regional challenge, specifically systemic and contextual challenges in the integration of technology into PE teaching. It was argued that while teachers possess the motivation and positive attitudes necessary for digital transformation, their capacity to implement technology effectively in pedagogical settings is often limited by gaps in digital skills. PE teachers' lack of access to technological infrastructure or to localized digital content limits their opportunities to develop and use their digital skills. As a result, PE teachers have limited ability to apply digital tools in movement-oriented and experiential learning contexts meaningfully. For example, some teachers are not exposed to digital platforms for motion analysis, virtual demonstrations, or fitness monitoring, which restricts their use of these technologies to improve instructional design and students' engagement (Kaur et al., 2022). The lack of culturally and pedagogically relevant digital materials hinders the contextualization of teaching, lowers students' motivation to learn, and creates a misalignment between technology and curriculum outcomes (Rashid et al., 2022). Consequently, despite their acceptance of technology, PE teachers may still have lower digital skills and choose just to use the tools given rather than design or innovate new digital learning environments (Ahmad & Rathakrishnan, 2023).

Belisario (2023) highlighted that we need a context-specific capacity-building to improve digital skills among PE teachers in Asia. This can be done through strategies like targeted professional development programs, investment in localized digital resources, and the provision of reliable technological infrastructure to support teachers in using their digital skills. High digital skills among teachers can help address infrastructural inequities and promote pedagogical innovation. PE teachers can integrate technology to design culturally relevant and pedagogically effective learning activities. In this sense, digital skills are the transformative link between PE teachers' willingness to innovate and their ability to implement meaningful digital integration.

Zhong and Juwaheer (2024) further emphasized how digital skills development can increase pedagogical contextualization in PE. The study found that digital training programs across Asia have a generic scope. They largely focus on building general ICT skills, such as the use of software or digital literacy. It was argued that specialized digital skills required for physically interactive and movement-based subjects have been

largely overlooked. In this sense, the lack of domain-specific training in PE can hinder teachers' ability to integrate digital tools meaningfully into their teaching practices.

In terms of teacher training, the provision of one-size-fits-all professional development programs takes away PE teachers' freedom in applying digital skills that suit their aspirations. In this case, while PE teachers are exposed for to different tools like motion analysis software, digital video feedback, wearable fitness devices, and interactive platforms to track and assess students' performance (Kaur et al., 2022), however, as noted in Zhong and Juwaheer (2024), most existing training models are still focused on theoretical ICT use than in practice. As a result, despite their high awareness of technology, teachers are still underprepared to integrate these skills into meaningful physical activities.

PE teachers should be empowered to use suitable digital tools for teaching. This is because PE is a discipline-sensitive and practice-oriented subject and digital competence development programs for PE teachers should integrate experiential learning, contextualized simulations, and collaborative digital pedagogies replicating the active nature of physical education. Likewise, past studies have highlighted a mismatch between digital training content and PE pedagogical needs. As a result, teachers receive training that are not contextualize to classroom situations, hence, they are unable to transfer their digital skills to the PE classrooms. They also still rely on traditional teaching methods. Each country also has different policies in promoting digital technology in classrooms, while some countries are supporting digital transformation in education , others are still left behind due to lack of access funding, infrastructure, and support systems. This has caused inconsistent digital integration in classrooms across the continent.

The lack of targeted initiatives has caused teachers' digital skills to remain low, and they are only able to use digital technology at the surface level, rather than as innovators or creators of digital learning systems (Ahmad & Rathakrishnan, 2023). In this light, real digital transformation in education should focus on professional development for teachers that goes beyond general ICT literacy to a more contextually grounded digital pedagogy. This is important to improve the cognitive and physical dimensions of PE teaching. This is in line with the DigCompEdu framework (European Commission, 2019), which extends the digital skills beyond technical ability. They consist of the capacity to design, facilitate, and assess learning by using culturally and contextually relevant technology.

Studies have found a clash between policies and practice, creating challenges in the development and application of digital skills among Physical Education teachers. Despite national and regional support for digital transformation and 21st-century competencies, there is a lack of systemic support. Teachers are not able to use digital skills meaningfully and their practical implementation remain limited (Belisario, 2023; Zhong & Juwaheer, 2024). The European Commission's DigCompEdu Framework (2019) noted that digital skills go beyond the ability to use technology. They should include effective use of digital tools for communication, collaboration, content creation, problem-solving, and using the digital environment in a safe and ethical way. However, due to insufficient institutional infrastructure, policy support, and professional development, teachers' opportunities to develop these competencies will be severely limited.

The disparity between policy and practice has also widened the gap in digital skills among PE teachers, especially in urban and rural areas. In this light, teachers in urban schools are more advantaged as they often have greater access to technology, training, and peer collaboration networks. This creates a high opportunity for them to improve their digital skills through ongoing practice and support. On the other hand, rural schools are usually underfunded and lack resources, and as a result, teachers in rural schools face many challenges, such as inadequate internet connectivity, limited access to digital devices, and low exposure to hands-on digital training (Ahmad & Rathakrishnan, 2023; Rashid et al., 2022). This form of structural inequality has caused teachers to have low readiness and deprive students of exposure to digital learning. This situation inherently shows educational inequities between urban and rural schools.

There is also mismatch between digital policy goals and teachers' actual capabilities. This calls for a context-responsive professional development program that suits the practical and interactive nature of PE. Teachers often receive general digital literacy training instead of specialized skills training to train them to use digital tools to design, facilitate, and assess physical activity. As a result, teachers rarely use digital tools, wearable fitness technologies, video-based movement analysis, or gamified performance-tracking tools (Kaur et al., 2022) in their lesson planning. It is also important to note that digital skills training should not just focus on infrastructural investment, but also on pedagogically relevant training frameworks to help teachers translate digital competence into effective classroom practice. Therefore, there is a need

to address institutional disparity to ensure equitable, sustainable, and discipline-appropriate digital transformation among PE teachers.

Culturally and contextually relevant digital teaching materials could help address issues stated in previous studies. In this sense, specialized training programs are helpful in fulfilling PE's pedagogical demands. This encompasses infrastructure improvement and ensuring equitable resource distribution to empower PE teachers to use digital technologies. This can help create dynamic, inclusive, and effective PE lessons.

Magallanes et al. (2024) found that PE is often sidelined in national digital education strategies. This caused PE teachers to lack training opportunities and, consequently, have low digital competencies. They were also found to have low readiness to shift to a more virtual, practical, and movement-oriented teaching and learning practices. In the meantime, the COVID-19 pandemic has pushed forward the need for digital transformation across the education sector (ASEAN Secretariat, 2024). It further underlined the roles of digital skills in helping PE teachers fulfil the complex demands of technology-mediated learning. The reliance on virtual learning created a significant challenge for many teachers who were still unprepared to adopt and adapt to online pedagogical environments. During the pandemic, challenges reported by PE teachers include poor connectivity, a lack of equipment, and low student engagement (Aguinaldo, 2021). This situation exposes significant gaps in both infrastructural support and digital skills proficiency as the restricted movement order hindered teachers from conducting face-to-face lessons. Teachers resorted to online PE teaching and faced obstacles in planning dynamic, participatory, and kinaesthetically engaging learning experiences.

As teachers turned to virtual learning during the pandemic, the world began to see the importance of digital skills in improving teachers' pedagogy. Teachers with high digital competencies have become more advantaged as the skills help them shift their instructional approaches into the virtual domain. They are able to use technology to simulate physical activities, monitor student progress, and retain students' motivation during virtual learning. The pandemic also revealed a wide digital divide, which can disadvantage practical disciplines like PE that rely on face-to-face interaction and physical activities.

During the pandemic, we can see the importance of aligning digital transformation with teachers' competence. In this sense, teachers with no digital skills

are incapable of integrating technology effectively into teaching. Hence, PE teachers should possess competencies like designing interactive instructional materials, conducting video-based movement analysis, using fitness applications or wearable devices, and providing real-time performance feedback digitally (Kaur et al., 2022).

Magallanes et al. (2024) further argued that the lack of discipline-specific digital training has widened the gap between policy-driven digital initiatives and classroom realities. Therefore, to achieve sustainable and equitable digital transformation in the post-pandemic era, it is imperative to strengthen PE teachers' digital competencies through targeted professional development, infrastructure investment, and the creation of contextually relevant digital pedagogical resources.

In Malaysia, while digital skills among teachers have gradually increased, there are still significant barriers, particularly for PE teachers. In general, teachers in Malaysia have reported a moderate digital skills (Chong et al., 2023); however, it is more challenging for PE teachers. They often have inadequate access to technology suited for physical instruction, weak internet connectivity, and examination-based system that prioritize academic results over innovation and creativity (Waller, McCullick, & Schempp, 2022). Some PE teachers also perceive that digital tools are not relevant to their subject area further impedes progress.

Another issue is the rural-urban digital divide. This gap has restricted the ability of PE teachers, specifically in rural, under-resourced schools to adopt and apply modern digital teaching methods (Chong et al., 2023). Hence, it is essential to develop assessment instruments specifically tailored to the unique demands of this subject so that we can effectively understand and enhance digital integration in Physical Education (PE). PE is a complex subject, and traditional digital skills assessments often fail to capture its complexity. It is important to note that PE has a dynamic nature. A large proportion of PE instruction focuses on movement-based activities and lessons are mostly conducted in outdoor, informal settings. Thus, context-sensitive instrument is required to assess ICT proficiency among PE teachers and to determine their readiness to use technology to improve physical learning outcomes and support students' motor skill development. Having a specialized measurement instrument is crucial for providing meaningful input on PE teachers' digital competencies and to guide the design of effective, targeted professional development programs.

There are many generic assessment tools available. However, they are often limited to certain constructs. This highlights the need for tailored instruments. Eignor

(2013) mentioned that to prevent wrong assumptions about competence, a thorough understanding of the design and intended outcome of an instrument necessary when determining the validity and reliability of any assessment. As argued in Tsang et al. (2017), using an instrument for a demographically or professionally different population can lead to low construct validity. It was argued that despite popular frameworks like DigComp 2.1 (Carretero et al., 2019) considered comprehensive for the general population, they do not have specificity to be used on professional educators. It is also important to note that instruments designed for subjects like science or language education are not able to capture the psychomotor, spatial, and real-time feedback dimensions of PE. Grekova and Kershner (2023) empirical study designed and validated a 20-item digital readiness instrument. The study found that even though the instrument items are linked to teachers' pedagogical and professional activities, these items are not specific to PE and fail to assess movement-based dimension. This shows the limitation of general teacher digital assessment models. Studies have also highlighted limitations of self-assessment approaches. Giannakos (2022) reviewed instruments assessing digital literacy among teachers. The study found that 85% relied solely on self-report formats, leading to over- or under-estimation of actual competence. This raises validity issues, particularly for disciplines like PE. It can be argued that performance-based measures may be more appropriate and reliable for PE teachers.

The development of a specialized PE digital competence instrument require robust psychometric techniques. Hence, Confirmatory Factor Analysis and Cronbach's Alpha should be included to ensure construct validity and internal consistency. A past study has demonstrated the development of a validated digital skill and literacy instrument using CFA. It demonstrated high reliability (Cronbach's $\alpha > 0.90$), confirming both internal consistency and construct validity across several dimensions like creativity and collaboration. Guo et al. (2024) documented the development of a high-quality, multidimensional AI-acceptance scale. The face, content, construct, convergent, and discriminant validity of scale was rigorously validated, and 27 items were developed to measure digital skills in the education context.

Past studies have demonstrated that the results of digital competency instruments that do not focus on a specific subject tend to unreliable and cannot be generalizable when they are used on populations outside their initial target group. In education, such limitation is particularly significant due to the differences in pedagogical approaches, learning objectives, and classroom contexts that affect how

digital skills are applied in classroom. A study by Baharuddin et al. (2021) developed a comprehensive digital competency instrument for Malaysian educators that come from different academic backgrounds. However, this study has excluded physical education (PE) teachers from the sample. As a result, it did not capture the unique teaching realities and digital demands in PE classroom, which are different from other academic subjects.

Thus, data collected using a generic instrument like one developed by Baharuddin et al, could lead to misleading findings on digital skills among PE teachers. This is because PE teaching involves unique instructional methods that focus on kinaesthetic learning, real-time feedback on physical movements, and outdoor activity management. All of these are not typically addressed in generic digital skills instruments. PE teachers may use technology like video analysis to teach the correct technique, fitness monitors and augmented reality tools to simulate physical environments. As these activities are only done in PE classrooms, generic classroom-based, cognitive task based assessments may fail to capture the critical components. The cross-application of digital competency instruments across different educational domains and regions is also challenging due to the influence of cultural, linguistic, and contextual factors. This occurs in Malaysia where there is a diverse cultural landscape and people tend to speak two or more languages. This calls for assessment tools that are subject-specific and culturally and linguistically responsive to local teaching conditions. Lim & Chai, (2022) also argued that instruments developed for one specific group may not be able to cater to difference in access to technology, pedagogical approaches and languages. This will result in low validity when it is used in different contexts. These challenges highlight the need for discipline-specific instrument design. In this case, digital competency assessments for PE teachers should focus on the digital tools, pedagogical strategies, and environmental factors that are specific to PE. Such tools would develop more valid and reliable measurements of such digital skills and subsequently promote studies that create dedicated professional developments for what is truly realistic for a PE teacher's daily demands in Malaysia.

Yet PE differs from other subjects and therefore complicates the integration of digital technology in PE classrooms. PE is a psychomotor, cognitive and affective subject (Rink & Mitchell, 2003). The first is the psychomotor domain. It concerns developing physical skills and motor abilities. The second is the cognitive domain with a focus on understanding rules, strategies and health-related information. Thirdly, the

affective domain focuses on the attitude, motivation and social interaction of the student. In Malaysia, PE constitutes 25% of the syllabus devoted to skill acquisition and mastery of movement and 75% devoted to health promotion and physical wellness. Thus, a PE teacher must be physically competent, with a behavioral change emphasis on students. Therefore, a flexible approach to teaching required. Consequently, PE teachers have digital competences unique to this learning space as their digital skills intended to foster such learning gains. In the digital world, educational tools include virtually demonstrated tools, augmented reality (AR), gamified fitness apps, etc. For example, virtual demonstration techniques (i.e., video) can be used as detailed perspectives on complicated motor skills while AR can provide an immersive digital experience that takes the real world and applies it to a simulated challenge or application.

Gamified fitness applications act as positive encouragement for students as they change up normal exercising methods into fun, goal-oriented projects that keep students engaged for long periods. But access to such technology is not enough for successful implementation where the classroom is concerned. Instead, educators must be aware of how to navigate these resources, assess them for unique physical education requirements and practical implementations and make certain they meet learning objectives (Wang et al., 2022). Otherwise, these resources go underused or become unable to be implemented in a manner that assists PE specific learning requirements.

Abrosimova (2020) defines education digitalization as the use of digital resources - mobile, digital resources, web-based resources - for the implementation of lessons in question. This definition is somewhat static across the literature with only minor variances found within the conceptualizations. For instance, some studies relied on purely technical capabilities and ICT literacy or the technical skills acquired for use digital tools or programs (Md Yusof, 2023; Sari, 2024). Other studies take a more holistic approach, incorporating critical and reflective thinking, problem solving and product development which are all necessary for digital tools to be utilized effectively for classroom objectives (Ferrari, 2013). Therefore, digital competencies relative to physical educators are much more expansive than merely possessing the technical skills to do so; they must employ digital constructions for remote and absent students, rely on collaboration efforts online and use data analytics systems to address diverse classrooms from aggregated data sets about student performance. Yet educators face structural limitations that impede digitalization efforts. In this regard, the limited use of digital

tools within physical education is not purely a byproduct of learning or competency issues.

PE teachers face inequities in physical and virtual resource availability and PE education as part of larger institutional structures and supports. For example, there is an infrastructural gap across ASEAN nations. For example, rural schools are predominantly under-resourced where digital devices, internet reception and support for technology are few and far between, with (Alakrash & Razak, 2021; Muhamad Ali et al., 2024). As a result, teachers don't teach with digital resources and rely on pen and paper in the classroom with no virtual assessments and limited professional development. Thus, even if teachers possess digital competencies and the willingness to engage with technological engagement, they are stifled by factors beyond their control. Furthermore, PE is an under-resourced, overshadowed component of broader curricular policies. For example, PE is often observed within the lens of larger curriculum development policies but does not boast priority in funding efforts as it's based on the empirical perception of PE as a non-academic subject (Tan et al., 2023) for PE curriculum digitization and tech-oriented professionalization for PE educators is insufficient institutional support. Therefore, gaps exist for PE teachers to garner similar advantages through understood technology-based advancements in education to assist digital transformation through established digital competencies and resources. Thus, only when inequities in such systems are remedied will PE teachers be able to utilize digital competencies and afford equity of access for all students, regardless of geographical or socioeconomic positioning.

These two levels of digital competences are also influenced by demographic factors such as gender and teaching experience, as well as geographical reach. For example, empirical research (Dodel & Mesch, 2018; Vázquez-Cano et al., 2017) suggests that male PE teachers have a higher average digital self-efficacy than female teachers, relative to resources, training opportunities and institutional inclusion. Sociocultural factors come into play as male teachers are more often exposed to technological devices than female teachers in and out of the classroom. Thus, they are more accustomed to using devices and more self-assured in using them (Hargittai & Shaw, 2015). Conversely, females are relatively equally equipped with digital competencies but are constrained by socioeconomics and more experiences with systemic setbacks like gender bias, gender discrimination. They also have fewer growth opportunities relative to professional development (Kirkwood & Price, 2014). Thus,

with a decreased sense of self-efficacy and willingness to implement digital devices (Prieto et al., 2020), gender discrepancies exist that need to be examined as a means of creating equity. In future observations, increased equitable access to technological devices, training opportunities, and supportive institutional environments are key findings that potentially provide support for all teachers' digital competencies. However, there was no statistically significant impact between genders where digital competencies were made available to both equally. Another contributing factor is experience with digital technology in the PE classroom. For example, Hun et al., (2020) found no statistical significance between years of service and technology use; however, López-Belmonte et al., (2019) and Hämäläinen et al., (2021) explored some level of connection. They note that experienced educators with significant educational expertise and classroom management skills tend to be more effective in integrating technology assuming institutional supports and professional development opportunities are there. They also know the learning expectations tied into the curriculum which helps with using digital tools from an enhancement perspective. However, novice teachers possess increased digital agility since they are exposed to technology-integrated classrooms from a young age along with their own training for their careers (Ertmer & Ottenbreit-Leftwich, 2010). Yet they may have more technological skills but less hands-on teaching experience for PE and classroom management can limit their integration of technology into lessons. This establishes a need for differentiated professional development programming for teachers in different stages of their career that combines digital training with applicable PE pedagogical components.

Geographical location impacts PE educators' digital competencies as well. Urban educators tend to have access to better infrastructure, devices and connectivity. This means more digital inclusion and diverse application (Alakrash & Razak, 2021). On the other hand, rural or underserved educators do not get technology to limit them as often, indicating less acquisition and application of digital competencies to exacerbate educational inequity (Muhamad Ali et al., 2024). Thus, the urban-rural connection requires policy support to reduce the digital divide as an implication of required similar professional learning opportunities and resources given to and available to urban and rural schools. If this is not the case, PE educators will become increasingly digitally incompetent. Digital incompetent educators tend to utilize traditional, antiquated teaching methods which provide one-sided, disinteresting student experiences (Sánchez-Cruzado et al., 2021; Salikhova et al., 2020). However, educators

who have superior digital competencies can offer dynamic, student-centered experiences with a focus on 21st-century competencies, information literacy critical for collaboration and creativity, and problem-solving efforts (Redecker, 2017). Thus, the connection persists in rural and urban areas which need to be bridged for the benefit of PE educators.

Thus, the interconnected nature of these findings demonstrates the demand for a context-relevant and reliable instrument for assessment of digital competencies for PE educators. Such an instrument will provide reliable baseline data aligned with digital competencies for pedagogical and practical needs of the field based on PE educator input. With this information, policymakers and administrators can better craft and implement relevant professional development measures and policies that reflect educator needs as highlighted in recommended PE digital competency guiding measures. Ultimately, such an outcome will ensure all educators can make inclusive and effective implements with integrated digital competencies so all students - regardless of demographic or geographic considerations - will reap the benefits of what the modernized learning world can provide.

1.2 Problem Statement

Technology integration in Physical Education is a critical, but still largely ignored area; hence, the development of a specialized instrument to assess digital skills among PE teachers, particularly in Selangor, can put a spotlight on this aspect within the broader context of educational technology integration.

Past studies have developed digital skills instruments targeted for general teaching populations. The instruments often lack the contextual focus required for accurate measurement for PE teaching and learning (Baharuddin et al., 2021; Md Hashim et al., 2024). The use of generic tools without contextual adaptation and psychometric validation can compromise construct validity and lead to misinterpretations, limiting the practical use and generalizability of the findings.

Past studies highlighted the need for psychometrically robust tools. Knekta (2019) emphasized that, when used in new settings, there is a need to validate new and previously validated instruments that are population- and context-dependent. Kane (2016) noted the need to measure an instrument's validity in each application. Baumgartner (2005) argued that researchers should not assume that an instrument's

validity is transferable across different educational populations. Thus, the present study aims to develop and validate a context-specific digital skills assessment instrument for PE teachers in Selangor. It is believed that this study can provide psychometrically sound data to guide targeted interventions, policy formulation, and curriculum design.

Another concern is the level of digital skills among PE teachers. Past studies have reported significant gaps in digital competence among PE teachers across different states and countries. Rojo-Ramos et al., (2020) Spanish study found that 8% of 201 primary school PE teachers demonstrated no or low digital teaching competence, specifically among senior teachers. Similarly, a survey conducted in Bojonegoro Regency, Indonesia, found that 25.06% of 12 high school PE teachers had low digital literacy, particularly among those with limited technological mastery (Adi et al., 2023). In Germany, 17.55% of 57 high school PE teachers demonstrated low computer literacy and rarely integrated technology into their teaching (Kretschmann, 2015). Another study by Saiz-González et al. (2025) reported that 16.6% of primary PE teachers perceived their digital competence as low. In the Southeast Asian context, a survey of Malaysian teachers by Irwahand et al. (2022) found that 44 teachers had excellent digital skills, 41 had moderate skills, and 27 had low skills. Other studies conducted in ASEAN countries revealed that compared to other teachers, PE teachers often have lower digital proficiency. This reflects the urgent need for structured, targeted professional development programs to improve PE teachers' digital literacy. The lack of digital skills can undermine teaching quality and student engagement. Thus, this study aims to measure the digital skills of PE teachers in Selangor to support targeted capacity-building programs. Therefore, the present study aims to determine the level of digital skills among PE teachers in Selangor using a valid and reliable instrument.

The significant digital inequities also pose threat to effective technology integration in education. Despite technological advances, there are still widespread structural barriers, including the lack of infrastructure and limited internet connectivity, especially in rural areas. Only 20% of rural residents in the European Union possess above-basic digital skills, compared to 33% in urban areas (Eurostat, 2021). Similarly, there remains a significant gap in Malaysia (The Borneo Post, 2024) and other developing regions (Zhou et al., 2024). There is also the challenge of gender disparity. For example, in the Philippines, female PE teachers scored 30% lower on ICT proficiency than male teachers (Magallanes et al., 2024). Meanwhile, only 45% of female trainee teachers in Spain demonstrated digital confidence, compared to 68% of

male teachers (Díaz Barahona et al., 2018). Other significant factors in digital engagement include age and teaching experience, with younger, less experienced educators demonstrating higher levels of digital adoption and proficiency (Zhao et al., 2021; Tou et al., 2020; Cantú-Ballesteros et al., 2017).

There are two goals for this study, (1) to determine the level of digital skills among PE teachers in Selangor, and (2) to develop and/or validate a psychometrically sound, contextually relevant digital skills assessment instrument tailored specifically for PE teachers and to explore issues related to the level of digital skills, the disparities geography area and gender among PE teachers in Selangor. This study's findings can guide targeted professional development, promote digital equity, and support effective digital integration in physical education pedagogy in Malaysia and similar educational contexts.

1.3 Significance of the Study

This study aim to assess and identify the elements of digital literacy competencies of PE teachers in Selangor, Malaysia. The data to be collected will be assessed and analyzed quantitatively to provide suggestions for educational guidance relating to increased digital literacy. Microscopically, the findings will translate from instrument development from form creation to a level of validation and reliability sought in PE Teacher Literature. A generalizability of such instrument development is important to Malaysian PE teachers, thus, the data findings will uncover overarching levels of digital literacy competency of PE teachers across Selangor that may or may not be of interest to the MOE and other stakeholders. The MOE and other stakeholders should understand how digitally literate they are across the board to compare how digitally literate they are as a group compared to their elementary and secondary cohorts. Thus, such findings will help the MOE and other educational policymakers and curriculum developers understand if SELANGOR PE teachers are willing and adequately equipped to fulfill growing expectations to satisfy digitally mediated education. Furthermore, findings will highlight inequities internationally and within gender and teaching experience as well. For example, more certified teachers at schools that are non-digitally equipped need to receive more resources - MOE can find these schools and provide extra guidance. Schools without much digital capacity should be given additional support or at times more certified teachers. Gaps in relative

competencies between regions assist the MOE in planning for PE Teachers regardless of location and expands beyond physical differences of the schools themselves for PE Teachers to have additional support for achieving levels of digital literacy that would otherwise be inaccessible.

Ultimately, at a macro level, the Ministry of Education and the State Department of Education will derive plans for improvement based on this research findings which would underpin professional development opportunities for digital skill advancements and digital skill assessments for teachers. These professional development opportunities should be structured in a way that any PE teacher, no matter their digital skill level, can benefit from it. This will benefit teachers who are still apprehensive to apply technology in the PE classroom. Additionally, it will make a less biased and more equitable approach for teachers in differing urban or rural school settings as all can be provided with the same level of quality training and opportunity. Moreover, with an increase in digital resources, the easier professional development fosters these skills, the more PE teachers are empowered to confront 21st century classroom situations with confidence. At a micro level, this research is a series of instruments with high reliability and validity to test a PE teacher's level of digital literacy. The MOE will have instruments that are in real time to help a teacher examine their digital skills across educational platforms, online information and presentations. This will assist the teacher not only by self-assessing but also by building upon what they already know through digital skill assessments from other digital tools. The instruments will help assume an assessment level of digital skill proficiency and struggling areas. PE teachers will be able to understand the ways that they can digital technologies to improve pedagogical approaches to make learning more engaging and interactive.

The findings can benefit PE teachers in several ways. First, it builds awareness on the importance of improving their digital competencies. This is particularly beneficial as teachers nowadays should keep abreast of technological advancement and new pedagogical strategies. Second, this study highlights the advantage of high digital skills. It is line with the push of education transformation, including in PE, Interactive technologies and multimedia resources can be used to create more interactive and interactive learning environments, attract attention of the students and encourage them to participate actively. Besides that, the findings will motivate PE teachers to get involved in ongoing professional development for improving digital skills. It makes teachers aware of the long-term benefits of digital integration; for example, in making

PE lesson more engaging and help students achieve the learning objectives.. The evolving digital skills among teachers will make them capable to apply more exciting teaching approaches, conduct more active lessons , and introduce students with tools to prepare them for the increasingly digital world.

In summary, this study provides insights into the practical and systemic levels of technology integration in PE to aid understanding of PE teachers' current digital capabilities in Malaysia, as well as to assist in developing targeted interventions to improve digital literacy in Malaysia's educational system. By focusing on both the micro and macro aspects of digital skill development, the study has significantly advanced predictions about educational practice and policy, namely, how PE teachers are prepared to deliver their services amid increasing reliance on digital technologies.

1.4 Research Objectives

This study investigated the level of digital skills among PE teachers in Selangor. The following are the research objectives of the study:

- 1.4.1 To establish the construct validity evidence of digital skills questionnaires among PE teachers in Selangor.
- 1.4.2 To explore the level of digital skills among PE teachers in Selangor.
- 1.4.3 To determine the differences in digital skills among PE teachers in the urban and rural areas of Selangor.
- 1.4.4 To determine the differences in digital skills between gender and age among PE teachers in Selangor.
- 1.4.5 To determine the difference in digital skills construct between urban and rural areas among PE teachers in Selangor.

1.5 Research Question

The following are the research questions for this study:

- 1.5.1 What is the construct validity evidence of digital skills questionnaires among PE teachers in Selangor?
- 1.5.2 What is the level of digital skills among PE teachers in Selangor?
- 1.5.3 Is there any significant difference in digital skills among PE teachers in urban and rural areas in Selangor?
- 1.5.4 Is there any difference in terms of digital skills between gender and age among PE teachers in Selangor?
- 1.5.5 Is there any difference in the digital skills construct between urban and rural areas among PE teachers in Selangor?

1.6 Limitations of the Study

This study is not without its limitations. There are several limitation that put constraints into this study. One limitation is that the sampling process was limited to male and female PE teachers from primary and secondary schools in urban and rural areas in Selangor. Furthermore, this research's measurement was developed to ensure compatibility and suitability for respondents' backgrounds and lifestyles. Thus, it is important to note that this study's scope is limited to PE teachers in Selangor and the findings might not be generalized to the entire population of teachers in Malaysia.

1.7 Operational Definition

This research uses a variety of terms and definitions.

1.7.1 Digital Skills

Digital skills are the ability to find, assess, use, share, and produce content using computers and smartphones. As the definition of digital skills differs by objective, audience, and context, it is challenging to define which skills are digital (Djumaieva & Cath Sleeman, 2018). Skills here span a spectrum of competencies, including but not

limited to operating hardware and software tools, using digital platforms for communication and collaboration, using multimedia and interactive content in teaching, and assessing digital processes and managing student progress. As such, digital skills involve critically evaluating digital information using the tools of the internet era in the educational environment, both when creating it and using what others have already created, while ensuring cybersecurity.

1.7.2 PE

One definition of “physical education” by Merriam-Webster (2002) ranges from basic calisthenics to a course of study that includes hygiene, gymnastics, and the performance and management of physical sports, and is an integral component of education that teaches students how to grow and care for their bodies. Physical Education is also described as a school-based subject that aims to develop students' physical fitness, motor skills, and knowledge of physical activity, health, and well-being. PE includes a variety of activities, such as sports, exercise routines, games, and fitness training, to encourage physical health, enhance coordination, and stimulate lifelong participation in physical activities (Bailey, 2006). Beyond physical skills, PE encompasses the cognitive and social components of academic education, teamwork, strategy, and sportsmanship - each necessary for well-rounded development for children. PE (Physical Education) is also assessed from an operational and real-world perspective. The empirical approach to PE involves what a teacher would prioritize in a purpose-driven, engaging, and safe classroom for student engagement (Kilue & Muhamad, 2017). This mirrors an international understanding of the classroom where PE initiatives involve more than just physical enhancement, but instead, substantial endeavors with great impact based on educational and sociocultural development. Thus, in this study's context, this operational definition also pertains to the role of the PE Teacher in instructional quality. The PE Teacher is responsible for teaching students about student wellness while partaking in such endeavors; for example, students understand the determinants of wellness and what it means to have a healthy lifestyle through constant, intentional physical activity. In turn, the PE Teacher is expected to appropriately teach in this subject area and implement modern-day resources for digitalization to best harness this learning opportunity. Therefore, one effective means of digitalized innovative teaching in PE is through the use of fitness tracking

applications. The operational definition of PE in this study is not limited to students' physical and motor development, technology usage, emotional growth, and development for healthy living throughout life. Therefore, this is an experimental study that legitimizes the expansive definition of PE beyond just physical exertion. PE is also related to cognitive, emotional and social growth for the child, which empowers this greater learning.

1.7.3 PE Teacher

A physical education (PE) teacher is responsible to facilitate in physical activities, fitness practices and health education in a school setting. . PE teachers are responsible for creating and implementing curricula designed to shape students' physical development and motor skills, promote overall wellness, and encourage cooperation, discipline, and social activity in sports and physical activities (Kirk, 2020). Besides teaching, PE teachers are expected to function as role models and instill in students the habit of lifelong physical activity and healthy living (Newell, 2011). To meet the high expectations of this job, they must be highly knowledgeable of physical education content, pedagogy, and assessment, as well as adaptable to the needs of diverse learners in individual and group settings (Tinning, 2009).

For this study, a sample of PE teachers is taken from option and non-option teachers. The teachers are the option teachers who have a Degree in PE and teach PE subjects in schools. The other non-option teachers are those with degrees in different subjects who have undergone in-house training and have been teaching PE subjects in schools for more than 5 years (Syed Yahya et al., 2024).

1.7.4 Validity

In this research, the term 'validity' signifies the extent to which a concept is precisely not only in quantitative study but in qualitative study as well. In other words, validity refers to the extent to which a tool measures the attributes of a construct (Heale & Twycross, 2015) and whether it measures what it is supposed to measure. It is a critical concept in research as it ensures that the conclusions drawn from data are credible, accurate, and reflect the construct being evaluated. In the context of educational studies, validity indicates that the tools and instruments researcher used can

assess teachers' skills or behaviour. More specifically, content validity is the extent to which the items in a test or assessment cover the whole domain being assessed. Other types of validity that are equally critical involve construct validity, which assesses the extent to which the instrument operates with constructs and theoretical models related to the topic at hand (Sireci, 2020) and criterion-related validity which assesses the instrument's ability to predict what other measures/criteria are expected to predict. (Heale & Twycross, 2015).

Validity is critical so the measurement of PE teachers' digital competencies truly assesses the level of digitalization based on their method of using digital technologies in the classroom. Research lacking validity can produce findings that are inaccurate. In this light, the instrument and any conclusions drawn from it will be deemed unreliable. The reliability and accuracy of the research findings can be determined when there is strong validity. This indicates that the results are applicable to the population being studied. If the instruments used are valid, the study can provide valuable insights into the digital skills of PE teachers and offer recommendations for digital competency in educational settings.

1.7.5 Reliability

Reliability indicates consistency (Heale & Twycross, 2015). If the same result can be obtained repeatedly with the same methods and under the same conditions, this suggests that the measurement is reliable. Reliability in qualitative research, as opposed to other research, refers to consistency, stability, and repetition of results because the results of a researcher's findings are considered reliable if consistently achieved in similar but different circumstances.

Reliability in this study is the stability and consistency of the measurement instrument over time so that the instrument produces consistent results when used repeatedly under similar conditions; the first type of reliability discussed in this study is internal consistency reliability, which is the degree to which the items in a test or assessment are consistent in measuring the same construct. Cronbach's alpha or any other such coefficient, which is essentially a statistical measure of how much the items in a test or questionnaire correlate with one another, is often used to assess this. This means that the test items are reliable indicators of the same underlying construct, as evidenced by high internal consistency.

Another important aspect of reliability is test-retest reliability, which takes the stability of the results when the same instrument is administered to the same group of people at different times (Kline, 1994). This study engaged several raters to evaluate PE teachers' digital skills, hence, inter-rater reliability is employed to assess the level of agreement among raters. Inter-rater reliability can be used to determine study's consistency and objectivity. It ensures that the raters' evaluation of abstract aspects, specifically PE teachers' digital skills and effectiveness of technology adoption, is free from bias caused by the raters' personal beliefs. When there is a high inter-rater reliability, the raters have the same interpretation and responses.

A high reliability means that the same item will generate the same responses when asked in different contexts. Reliability is imperative because it is an element used to assess internal consistency, test-retest reliability or stability, or inter-rater reliability. Therefore, the instrument can be trusted to consistently evaluate digital competencies of PE teachers and produce results that are highly reliable and dependable. High reliability is needed for researchers to determine possible advances in PE teacher digital competencies. In addition to good inter-rater reliability, Cronbach's Alpha is used for instrument reliability in this study.

1.7.6 Adaptation

Adaptation is important as an effort to avoid issues where respondents might get confused due to language and cultural differences that confuse them otherwise. Good adaptation reduces the risk of error and miscommunication (Hall et al., 2018). Webster defines adaptation as "the state or process of adapting or being adapted; a modification." Thus, it is often celebrated in an academic setting as constantly changing classroom needs, teaching styles, and emerging technologies require constantly adapting educators.

Adaptation is the PE teacher's ability to adjust standards, expectations for student participation, etc., regarding methods and technological use for continual and shifting demands and expectations of the classroom and educational system (Kretschmann, 2015). For example, with continued digital advancement implemented in lessons and digital PE classes, PE teachers should adapt their standards and expectations for student participation to what innovations exist in the modern day.

Technology adaptation refers to the teacher's ability to take information, learned skills, and acquired technology by the teacher and adapt its use for educational means. For example, new educational technology or digital technology that could be acquired would be fitness wearables, video assessments, and apps for education that could all be used in a PE lesson (Hobbs & Tuzel, 2017). It's how a teacher is prepared and makes use of new technology that determines whether it will be successfully adapted. Therefore, PE teachers should be encouraged to use these technologies for different tracking purposes or to give personalized feedback to students.

Adaptation is an essential process of understanding which empowers PE Teachers in a digital world. PE Teachers must adapt whether socioeconomic divides exist among students' access to technology or the planned curriculum seeks 21st century educational objectives. Adaptation is beneficial for PE teacher learning but expands educational change. Yet such change will not happen if PE teachers are inadequately prepared to support changes in technology and digitization.

1.7.7 Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis is a statistical technique that seeks to determine (at least on a tentative basis) constructs - sometimes referred to as factors, dimensions, latent variables, synthetic variables, or internalized characteristics - that sufficiently account for the covariance among a series of (at least) ten variables. These variables are considered a series of manifest variables, observed variables, effect indicators, reflective indicators or surface traits (Watkins, 2018) and the goal is to uncover the variables that cause the arrangement and organization of the assessed variables. It posits that the constructs are something not seen but, rather, an internalized characteristic that causes variability in the assessed variable score (Bavel et al., 2020).

EFA was utilized first to examine the factorial structure and investigate how many latent variables underlie the relationships among observed variables (Watkins, 2018). For instance, the dimensionality reduction of extensive collections of data occurs through factoring similar variables into constructs that reflect the emergent factor (Costello & Osborne, 2005). There is an instrument for quantifying PE digital competencies that is both valid and reliable since this study intends to discover them. EFA will determine whether latent variables constitute the latent measurements to

confirm the instrument measures PE digital competencies to a degree of reliability for further research and practical application in the classroom.

Where this study is concerned, EFA works because it examines the different facets of digital skills that are not necessarily as easily found or championed through extant literature. Digital skills are not one-dimensional, and exploratory factor analysis (EFA) allows for the exploration of data and patterns and structures to find a better explanation of how technology impacts PE teachers' teaching skills. In addition, EFA establishes a factor structure from which results can be interpreted and variables that are underrepresented or underdevelopment in professional development for teachers can be differentiated. For example, EFA results suggest poorly represented, or only developing, standards across factors in PE teachers' digital skills meaning a strategic approach to programming options can be made from these findings.

Thus, EFA not only helps refine the measurement tool but also promotes the broader case for improving educators' digital competencies, which, in turn, will positively impact teaching effectiveness and student outcomes in Physical Education.

1.7.8 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) is a subset of structural equation modelling that analyses the relations between latent variables (factors) and their measures (observable indicators), including test items, test scores, and behavioural observation ratings. Latent-variable measurement models (e.g., factor analysis) are used to determine the number and nature of factors that account for the variation and covariation among a set of indicators. A factor is an unobservable variable that affects several observed measures and contributes to their correlation. The practical measures are correlated because the same underlying construct influences them; if the latent construct were not present, the practical measures would have no correlations. Therefore, a CFA-based measurement model provides a more complete understanding of covariation among a set of indicators since the number of factors is fewer than the number of measured variables (Cooper et al., 2013).

CFA differs from Exploratory Factor Analysis (EFA), which is used to discover possible factor structures and relationships among observed variables. In contrast, CFA is used to verify or confirm the presence of a predefined factor model in line with theoretical expectations and prior research (Zainudin Awang, 2015). Specifically, CFA

is handy when the researcher has a clear hypothesis about how observed variables should relate to latent constructs (in this case, the digital competency dimensions of PE teachers).

In the CFA process, the number of factors (latent constructs) and the pattern of the relationships between observed variables (such as survey items) and these factors are specified., CFA measures the goodness-of-fit between the proposed model and the empirical data collected from the sample after the model is established. In this light, it allows a complete evaluation of whether the data fit the theoretical model (Sum et al., 2016). CFA includes fit indices like the Chi-Square, which determines how well the overall model fits, and the Root Mean Square Error of Approximation (RMSEA). The model's goodness-of-fit is based on actual data and the Comparative Fit Index (CFI). The CFA shows the difference between the hypothesized and baseline models (Bentler, 1990) which allow researchers determine if the proposed factor structure reflects the underlying data, if the model fits the data well, or the model should be adjusted.

1.7.9 Rural and Urban Area

Rural living is different from urban living. Rural communities often have simpler habits, types of shelter, and manners than urban communities that lead a more complex, hectic way of life. This is because rural areas are less industrialized. In this light, the urban-rural divide is a key area to study to understand the economic and social development of developing countries. Studies on urban-rural differences often have two aims: to conduct a comprehensive analysis of urban-rural differences and to research specific urban-rural differences, such as education and income (Wang et al., 2020).

In this study, rural and urban areas are identified based on several demographic, geographic, and socio-economic factors. Urban areas are characterized by higher population density, more buildings, and a high concentration of economic, educational, and health infrastructure. In this sense, access to technology, transportation network and employment opportunities are relatively better than in the rural area. Job opportunities, specifically in critical sectors like , technology, and the service sector in the urban area are also more diverse. (Wang et al., 2020). As a result, the urban population are more diverse economically and culturally. More people choose to live in urban areas as these areas have more complex social dynamics, higher levels of educational opportunities and more facilities (Choung and Manamela, 2018). In this sense, teachers in urban

schools enjoy better access to digital technologies that can be integrated into teaching and learning (Lin et al., 2023).

Rural areas are less populated, and people are more focused on the food and resource-based industries as their economic suffers. Rural areas also tend to have more homogeneous populations. These areas are more remote which cause them to get less infrastructure (Ting & Ling, 2013). People in the rural areas have more limited access to resources, educational facilities, healthcare services, and technology innovations (Gómez-Carmona et al., 2023). Rural teachers limited access to technology hampers their ability to use advanced digital technologies in teaching. At the same time, teachers in rural areas lack professional development and are less capable of incorporating digital skills into teaching (Stenman & Pettersson, 2020) and their teaching practices still rely on traditional methods preferred. One reason for this is the lack of exposure innovative pedagogical approaches, compared to those in urban areas (Kusin, 2022).

In this study, rural and urban setting are operationalized based on the socio-economic and infrastructural characteristics. Undoubtedly living in the urban and rural area can impacts on different aspects of one's life, including education.

In this study, the researcher attempts to examine how the differences between rural and urban areas affect teachers' development and application of digital skills. This will allow us to classify it in a way that helps us better understand how geographic and infrastructural factors play a role in teachers' ability to incorporate digital technologies into their teaching practices, and how this may differ between rural and urban settings.

1.8 Conclusion

Overall, this chapter briefly introduced the background of this research. This research focuses only on the relationship of digital skills among PE teachers in Selangor. In this light, the problem statements highlight issues that give a clear image of why the research needs to be conducted. Furthermore, the researcher was concerned with the appropriate measurement for this study to collect reliable and valid information from the respondents by translating and adapting the original instruments and revising them to ensure compatibility with the research. Finally, the operational definitions were briefly explained to clarify the terms used in this study.

CHAPTER 2

LITERATURE REVIEW

The purpose of this research is to develop and adapt a set of new instruments to assess digital skills among PE teachers in Selangor. This chapter is divided into several sections to describe the process of developing and adapting a measurement of digital skills levels among PE teachers in Selangor.

2.1 Global Context of PE

PE, an acronym for Physical Education, is one of the core subject in schools around the world. Its main focus is on promoting health, fitness, and lifelong involvement in physical activities. As noted in DiPietro et al. (2020), the World Health Organization (WHO) has acknowledged PE is a critical subject for children's motor and social skills development and the personal growth of children and adolescents in schools.

PE should be a subject with great importance in international educational systems. It is universally beneficial and acts as a catalyst of comprehensive developmental growth while countering sedentary behavior. Internationally extensive curricula have been developed in line to the culture, educational proficiency, needs and wants of each nation. For example, the US curriculum, as noted by Burris (2022) uses a standards-driven approach, particularly concerning physical and social engagement. Furthermore, the 'European PE Curricula' (D'Anna et al., 2019) focuses physical activities as part of the PE process. Thus, these two curricula are centered on cultivating a wellness culture and an expectation to engage through physical education. Yet, despite its importance, PE education is not without complications. For instance, PE teachers internationally have the same concerns relative to limited funding, lack of trained teachers and unfortunately, schools that prioritize academic subjects over PE (Harvey et al., 2020). Moreover, gender differences influence students' participation in sports and access to physical activities (López-Belmonte et al., 2019). Therefore, these concerns should be addressed first before PE can successfully be integrated into any given educational system. Major innovations in digital technology have brought forth possibilities of improved engagement and personalized learning opportunities for PE.

Studies show how technology has turned PE into an interactive, adapted space for specialized learning (Haleem et al., 2022). A pertaining issue with technology in the classroom is how teachers believe they are least prepared to handle the use of technology due to a lack of training and the skills necessary for integration (Andoh Charles, 2012). Therefore, teacher training is essential for specialised professional development to support technology adoption among PE teachers in Malaysia.

The Malaysian government sees PE as a significant part of the National Education Policy. The National Sports Policy highlights goals to enhance PE for schools, and the Policy is established to produce Malaysian citizens with high physical fitness (Elumalai & Saryono, 2015). The policy structure connects to the intended purpose of cultivating a health and wellness framework for the entire country. Thus, PE syllabus standards in Malaysia are designed to ensure that students develop holistically and have balanced physical, mental and social development. The syllabus has been updated on several occasions to integrate critical thinking and a lifelong approach to healthy lifestyle (Kirk, 2005). Such updates reveal that PE remains dynamic and applicable for developing well-rounded citizens who can contribute to the society. Still, there are challenges faced by PE teachers Malaysia that prevent effective learning. These include a lack of materials, high class sizes, the relevance of teaching (Yelkperci et al., 2012) and their lack of integration with digital learning materials where many cannot properly show off their skills. (Akram et al., 2022). These obstacles prevent improved learning quality from being a reality.

As for PE's future in Malaysia, teacher training courses should put a specific focus on innovative teaching techniques and digital skills (Aziz & Abd Aziz, 2008). Such collaborations will lead to improved PE program quality and increased student engagement, supported by partnerships between schools and sports organizations (Viet Chau, 2023). With such partnerships and teacher development, Malaysia can further advance its PE initiatives and a healthy future generation. Therefore, PE teachers should have a set of digital skills to become effective teachers across both conventional and technology-based teaching methods, as technology is essential for effective teaching and learning today.

2.2 Digital Skills Concept

As described in Savolainen (2002), abilities are 'knowledge of the means or methods for accomplishing a task' or 'the ability to apply one's knowledge effectively and readily to perform a task.' The term skills can also refer to the formation of actions within a purposeful plan and the execution of that plan in an efficient manner. According to Xu et al. (2019), the core of "skills" is the power to perform a goal (Xu et al., 2019). Digital refers to the use of or related to computers and the internet. According to DiMaggio and Hargittai (2001), digital skills refer to the use of computers and the internet. As global competition becomes more knowledge-based, digital skills are becoming essential. The skills include carrying out simple, practical tasks online and a wider set of skills for working in remote environments, cross-institutional and cross-cultural teams, sharing and creating knowledge in digital environments, and adapting to changing job requirements. (Carnevale & Smith, 2013) and (Haleem et al., 2022).

It seems the level of digital skills matters most in explaining why people use the internet differently. Notably, it is one of the skills most susceptible to influence from educational policies, new media design, and the provision of websites and support functions. According to Bawden (2001), the terms and concepts used in the literature on digital skills are not consistent. Different ideas are interpreted in various ways (Martin, 2006), so there can be no agreement on what digital skills are or why they are needed. Further academic research is required. Studies by De Haan (2003) and Hargittai (2002) showed that there is a very wide range of digital skills across various social groups and sectors, economic, service, or education, but they do not explain what these skills entail. Although there are frameworks for measuring digital skills, most lack operational definitions. Consequently, they remain at the conceptual level of definitions, indicators, and measures.

In the context of education today, schools are required to teach students to survive in an increasingly mediatized society (Couldry & Hepp, 2013). Thus, from this perspective, the educational realm has sought to prioritize digital skills training and education to make it equitable, qualitative, and universally accessible. Such digital training have been central in educational and occupational training (West et al., 2019). There are many needs for ICT in the educational context. First, ICT supports equity and helps make information more inclusive (UNESCO, 2020). ICT also provides

personalized access to learning based on one's needs and preferences (Major et al., 2021).

In addition, ICT creates a collaborative learning atmosphere in which students can engage with others across the globe or become enriched by experts (Nicolson & Uematsu, 2013). It also empowers students with digital literacy skills necessary for 21st-century work environments (Davies & Merchant, 2014). Therefore, based on these arguments, digital literacy skills are necessary for students and teachers if they are to be prepared for a highly digital, technologically advanced world that caters to more intellectualized and skilled individuals.

2.3 Concept of Digital Skills and PE

Digital skills are defined as technical and cognitive abilities for finding, arranging, assessing, and creating digital information and resources. Digital skills range from basic computer literacy and familiarity with the internet as a learning tool to digital software and cybersecurity. Digital skills also involve higher-level cognitive efforts of information literacy, critical thinking, and creation. Therefore, students use them to access teaching materials/curriculum and cultivate research capabilities. Simultaneously, digital skills empower teachers to weave in specific technology for their teaching approaches for academic engagement and learning enhancement. Therefore, digital skills form the necessary foundation for adapting to and thriving in the ever-changing digital world (Fernández-Cruz & Fernández-Díaz, 2016).

Physical education is a basic aspect of physical development; it operates from a realm of concern beyond physical fitness. It is an all-encompassing subject focusing on physical and emotional growth. PE encourages an idea of physical activities that improve cardiovascular health, muscle tone, and flexibility. PE focuses on physical well-being and encourage students to practice a healthy lifestyle that can lower risks of chronic health issues like obesity, diabetes, and heart disease. In addition, it extends mental health where physical education fosters cognitive development and promote heightened memory skills, attention span, and problem-solving ability. It provides students with sustained attention and information acquisition to promote learning. Thus, academically, PE holds the same importance as other subjects. It has rich physical and emotional benefits. For instance, it can lead to stress reduction. This is because exercises drive the brain to release endorphins to manage mood. This helps student retain a new

skill and achieving a fitness goal, and at the same time, builds a self-esteem and confidence. Furthermore, physical education includes a social aspect through team/group activity and social development through leadership, communication and collaboration opportunities. It creates a sense of belonging, community building and help cultivates various skill development. Physical education promotes for lifelong active lifestyle; therefore, these students embrace such ideals into their adult lives. Physical education is crucial for a comprehensive educational approach as a foundation to produce of a well-rounded, healthy, and actively engaged person who can tackle life's challenges (Kwan et al., 2023).

Different forms of technology will be used in the physical education online classroom to provide constant visuals to enhance students' motivation and interest. Technology integration in physical education programs provides more individualized learning for students who are not comfortable with the subject. It also helps relieve stress in students' bodies, boost their confidence, and make them more efficient and prepared for online classes. Additionally, it enhances their ideas and capabilities. These changes should be embraced by physical education lessons and adapted to them. More skills and movement should be integrated into physical education as a part of highly effective physical education (Centeio et al., 2021), and PE teachers can appropriately support online teaching in physical activity. However, when we consider the complexity of the educational issues that teachers and parents face today, as opposed to the analogue era (Bayraktar, 2017), this statement becomes even more powerful. One educational issue in online teaching is students' lack of motivation to learn virtually, as studies have found. It was found that students in online classrooms were dissatisfied because there was no interpersonal interaction between the teacher and students. Another issue the online learning system does not address is that students need engaging courses from educational institutions to remain engaged. In this regard, teachers need to find an interactive and engaging way to deliver online learning.

Apart from that, the field of education is experiencing rapid development in Information and Communication Technology (ICT). Several educational study findings have demonstrated that the use of ICT as a tool to raise student achievement has its advantages (Kinchin & O'Sullivan, 2003). ICT resources have the potential to develop, accelerate, enrich, and expand skills and to motivate and engage students in learning. However, research suggests that although most teachers firmly attach value to ICT's potential to improve the learning environment, this potential has rarely been fully

exploited in practice (Shah, 2022). According to Abdul Bujang et al. (2020), ICT will be used to the best of its ability if competent teachers are ready and open to exploring new avenues for improving their classroom practices with ICT. Therefore, ICT will enhance the learning environment and prepare the next generation for their future lives and careers (Ghavifekr & Rosdy, 2015). Shi et al. (2021) observed that “virtual classrooms, a combination of websites and list servers, simulate real classrooms well and improve the quality of messages that can be conveyed in traditional classroom settings.” According to Polly et al. (2010), internet-based instruction must be based on successful learning that has beneficial real-world applications. Tsangaridou and O’Sullivan (2003) also found that for teachers to use web-based learning in practice, they must understand the theory of interaction between theories. Digital skills are challenging to integrate into physical education programs due to their unique nature. Therefore, it is essential to train PE teachers with strong knowledge and skills in using digital tools in the classroom.

Unlike other school subjects, physical education is unique in that it involves human movement and is seen as focusing more on physical activities. Thus, from a logical perspective, the human body can be regarded as the primary medium for physical education programs, and a gap emerges between technology and physical education. There are two possible lines of reasoning for this sense of a gap. Consequently, media and ICT could appear as a danger for kids and teenagers, taking away from them proper leisure time and physical activity. Media consumption is also portrayed to be 'fat, stupid, and lazy' for youth (Bastian, 2011). This contention is supported by numerous surveys (Marshall et al., 2004).

As in Chambers and Sandford (2019), the research identifies three ‘unique characteristics of PE and school sports programs: the subject matter, the learning environments, and the caring teacher-student relationships. They also claimed that there is widespread agreement that physical education and sports are where values, morals, and life skills need to be taught, not caught.’ This area is given due consideration in the development of educational resources, practices, and pedagogical approaches.

In the meantime, it can be argued that the use of media and technology contradicts the push for healthy physical activities at the heart of physical education. This argument claims that physical education makes up for students’ lack of physical activity outside of school. In contrast, technology promotes a sedentary lifestyle that cannot be combined with physical activity. Furthermore, physical education may not be

held in high regard or considered as important as other so-called major subjects. The exclusion of physical education from major global technology studies has led global research and policymakers' attention to shift to other important subjects, leaving physical education neglected. For instance, SITES (Second Informational Technology in Education Study) (Law et al., 2006) that focuses on second language acquisition, natural sciences and mathematics. In this sense, physical education is a course that has been around for centuries, and its content, standards and aspirations change as society changes. However, in contrast to other subjects, physical education is a subject that involves human movement and physical activities (Newell, 2011; Tinning, 2009). Therefore, as mentioned in Kretschmann (2009); Mohnsen (1997), PE is often not considered an academic subject.

The advancement of ICT and how it is being utilized for physical education has tremendously changed how PE is taught within the classroom. Thus, physical education teacher must possess digital literacy skills to aid teaching so that PE can be interactive and participatory (Ghavifekr & Rosdy, 2015). Digital resources enable PE teachers to create dynamic learning experiences, for instance through interactive whiteboards, learning and gamified fitness apps available through educational sites and VR applications that facilitate an immersive learning experience.

ICT also helps track student data ranging from physical movement to levels of achievement. PE teachers can utilize fitness trackers and wearables to better support their pedagogical approaches and cater to students' needs. In addition, online applications and video conferencing allow for PE to be taught outside of the classroom to a certain extent. Thus, PE must also learn digital literacy skills to operate these technologies in order to optimize the use of educational software that are useful in lesson planning. Physical education is a subject that necessitates digital skills to prepare students for an increasingly digital world where health and fitness are as equally important as academic performance.

However, the matter of digital tool integration into physical education is highly debatable. For example, Gard (2014) and Lupton (2015) discussed hinderance for the use of digital applications in the classroom while Casey et al. (2017) promote their innovative capabilities for physical education. Bodsworth and Goodyear (2017) stated younger generations are more inclined to support these technologies. Thus, digital skills should be integrated into PE due to their high real-world implications. Deng et al. (2023) asserted that digital applications have been integrated into the world of sports and

physical education context. For instance, game developers have started to develop immersive mobile games in line with increased numbers of smartphone and tablet users. Even classic sports like football have been redefined digitally through the FIFA football video games.

Videos can be integrated into PE lessons, for example, in assessing movement skills. Videos provide visual simulation which can be critical in hands-on subjects like as PE. Visual materials are necessary to help provide a comprehensive realm of learning. Thus, PE can be supplemented by video, although it might be more complex. PE teachers need to be knowledgeable about criteria for video selection. At the same time, PE teachers need adequate technical understanding and skills to foster relevant technical competencies within a learning environment. PE teachers need to know which apps are out there and how to recognize their values as well as general technology such as how to connect WiFi from computer to screen/camera screen and how to project videos on screens. These present an example of blended online instruction combining pedagogy and content knowledge.

As mentioned by Polly et al. (2010), teachers must not only master the subject content but also understand how the subject material can be transformed through digital skills. For instance, sports-related information can be combined with digital skills on social media. A teacher can use YouTube to find and share content that illustrates the cultural value of traditional games. The problem is that selecting appropriate images based on the student's interests remains a challenge. The play settings and motor skills that must be learned are more complicated when the visuals are supposed to promote play settings. In these circumstances, the visuals need to be customized to the student's capabilities and motivation. These images may affect the use of the teaching environment. With such a wide range of opportunities, it is questionable to what extent PE teachers are prepared to take this new technology into their daily teaching (Koekoek & van Hilvoorde, 2018).

There are many benefits for physical educators to explore digital technology and how it can best complement teaching and learning. From apps and wearables to online offerings, PE teachers can use digital tools to get real-time data, offer a more personalized experience, and a more integrated and purposeful interdisciplinary approach to PE curriculum. Within the world of PE teaching, digital technology, therefore, has many transformative qualities and occurs in many transformative forms.

Moreover, it has many benefits to support teachers and students in teaching and learning.

The first benefit associated with digital technology implementation for PE instruction is that PE teacher can create more engaging, interactive learning experiences. Simple devices like fitness bands or heart rate monitors (which are readily accessible for many, if not inexpensive) can be used to provide students with instant feedback about their physical performance and awareness. This real-time data provides tracking metrics over time that PE scholars can use to better understand their bodies and create personal fitness goals for gradual improvement of physical development. Furthermore, apps and online resources bring a more personalized aspect to assessing performance because exercises and practice drills can be tailored that represents various levels of fitness within one classroom setting that empower students to complete the task purposefully at their own pace.

Digital technology can facilitate a more inclusive PE experience is through. Technology and digital lessons can be used for differentiated learning for students with varying degrees of physical ability. For example, students who cannot keep up with a video or in-person can access video tutorials, interactive lessons, even online classes that break down physical movements into manageable segments. This aids in skill development and provide students extended time to acquire physical skills in a stress-free environment. Game-like scenarios can be simulated for a no-stakes approach to learning sports skills without the injury risks. Technologies such as VR and AR can help establish this game-like feeling as well as more time to practice physical movements. This makes students feel more invested and engaged, leading to higher student satisfaction and participation.

In addition, digital technology opens the opportunity to for teachers assess and monitor student achievement. It offers PE teacher yet another means of personalizing their pedagogical approach to students' individual performances. Software and applications can be used to determine students' levels of attainment and teachers can monitor student interactions and engagements, hypothesize on patterns observed, and provide even more specialized feedback. PE teachers should understand exactly how to assess their students' performances and aspects to focus on to support development. Video analysis software enables students to visualize sport skills, watch their progress done and even compare their skills and performance with professional standard. Digital resources can also be used for assessment and monitoring student progress to inform

PE teachers in formulating styles of teaching based on specific levels of performance. Teachers can make observations, collect feedback and generate engagement through programs and apps. This can help them provide more personalized insight. A more data-driven approach to assessment allows PE teachers to see whether students are performing well and give them feedback and encouragement. For example, students can use video assessment software to see their sports skills and body mechanics by comparing themselves to professionals and assessing their own form. This shows how the visual and analytical aspects of digital learning can improve motor skills and, subsequently, athletic performance.

Besides enhancing student engagement in PE, integrating digital technology in PE prepares students for the future by exposing them to digital literacy and technological skills needed in the 21st century. In today's fast-paced, changing world, a person would benefit from learning to use digital tools that help make their life healthier. Digital technology in PE not only changes the way PE is taught and learned but also gives students the power to monitor their own health and fitness path in new and creative ways.

Today's children and adolescents are called 'digital natives' (Prensky, 2001) as they are surrounded by ubiquitous technology from birth. Therefore, greater technology integration in schools is necessary to meet their needs (Dündar & Akçayır, 2014). The use of technology in the education system cannot be avoided, given the need for digital skills in the future, where the purpose of education nowadays is to equip people with digital skills. This method can be used to make the learning process more interactive and more meaningful to the next generation of students at this time. Likewise, PE teachers should master digital learning methods and have sufficient digital skills to use technology in learning and teaching.

2.4 Component of Digital Skills for PE Teachers

The researcher used previous instruments to identify the constructs that should be considered in determining the types of components in digital skills. The reference instruments are the Digital Competence Framework for Citizens (DIGCOMP) 2.0, Digital Competence Framework (DIGCOMP) 2.1, European Digital Competence Framework for Education, Common Framework for Teaching Digital Competence

(INTEF) 2017, and The Digital Strategy for Schools (UNESCO). This breakdown of constructs is as follows:

Table 2.1

The Breakdown of Constructs Taken from Several Frameworks

Construct	Reference
Information And Data Literacy	Digital Competence Framework for Citizens (DIGCOMP) 2.0, Digital Competence Framework (DIGCOMP) 2.1 European Digital Competence Framework for Education
Communication And Collaboration	Digital Competence Framework for Citizens (DIGCOMP) 2.0, Digital Competence Framework (DIGCOMP) 2.1 European Digital Competence Framework for Education
Creation Of Digital Content	Digital Competence Framework for Citizens (DIGCOMP) 2.0, Digital Competence Framework (DIGCOMP) 2.1 European Digital Competence Framework for Education
Security	Digital Competence Framework for Citizens (DIGCOMP) 2.0, Digital Competence Framework (DIGCOMP) 2.1 European Digital Competence Framework for Education
Problem-Solving	Digital Competence Framework for Citizens (DIGCOMP) 2.0, Digital Competence Framework (DIGCOMP) 2.1 European Digital Competence Framework for Education
Teaching, Learning, And Assessment	Common Framework for Teaching Digital Competence (INTEF) 2017, The Digital Strategy for Schools (UNESCO)

These digital skills are those that 21st-century teachers require to enhance their educational practices and professional development. The identified digital skills consist of six domains: information and data literacy, communication and collaboration, creation of digital content, security, problem solving, and teaching, learning, and assessment.

2.4.1 Information and Data Literacy

Information and data literacy includes the abilities required to manage the abundance of information, such as identifying trustworthy sources, analyzing data to derive insightful conclusions, and using this information to make defensible judgments and solve problems (Costal et al., 2023). Data literacy is such a new idea. The language is not entirely unified; hence, this study will use Kretschmann's (2015) definition of data literacy as the ability to access, comprehend, critically examine, manage, handle, and ethically use data as part of information literacy. Workers will need to manage both the volume and quality of information, particularly in an information-rich culture where knowledge is rapidly updated (Ross et al., 2016). To organize information properly for simple retrieval, information management abilities are required. Additionally, anyone can publish on the Internet, regardless of the quality of the content; however, people must first acquire the skills needed to handle digital information (Siddiq et al., 2016). Once the information has been gathered and organized, a person can transform and develop it in various ways to better communicate it to others and build their ideas or interpretations based on the task at hand (Ananiadou & Claro, 2009).

In physical education, information and data literacy are very important, especially for online teaching. Establishing an information-based platform and investing in network teaching resources are the goals of remote learning. In addition to relying on their profession for fundamental knowledge, teachers must have access to computers, the Internet, multimedia, and other related skills and competencies. Teachers must be able to create multimedia courseware and instructional materials as additional teaching tools. PE teachers had to teach basic knowledge and skills outside, and there were few multimedia, computer, and network technologies in use. Consequently, only a tiny percentage of teachers take the initiative to study without being pushed to. Most teachers rarely use technology in physical education lessons. The use of digital tools, including computers, the Internet, and digital cameras, in physical education classes was statistically significantly influenced by PE teachers' information and data literacy. Technology use in the classroom was more common among PE teachers with higher levels of information and data literacy. However, the population tends to consist of PE teachers who are not regular technology users.

2.4.2 Communication and Collaboration

Digital communication is any form of communication that relies on technology. Digital communication channels, on the other hand, encompass a wide range of digital communication formats. Digital communication includes phone conversations, video conferences, email, and several forms of instant messaging, including webchats and SMS. The ability to openly and effectively communicate emotions and reactions in a digital setting is one of these skills. These abilities also include establishing and sustaining contacts, prerequisites for utilizing network contacts with the resources needed to assist resource mobilization (Wolff & Moser, 2010).

Meanwhile, collaborative digital skills mean working together in a digital space with a common goal (Green et al., 2001). Although tasks may be better executed if appropriately separated according to strengths, all parties must possess an awareness of the endeavor (Bronstein, 2003). With many international virtual communities and separated work teams, a comprehension of the best means to promote employees' intentions to share knowledge online is beneficial in a competitive globalized society and the necessities for collaborative efforts to be connected on a greater scale. In essence, PE teachers need knowledge and skills in digital communication and collaboration; these skills will help them deliver their lessons in the classroom. Good communication and collaboration skills can help students understand the subjects taught, and PE teachers can also monitor students' learning efficiently.

Apart from that, teachers could also demonstrate classroom elements —such as form, rules, and procedures —by incorporating technology into classes, providing visuals for all students to learn. Smart TVs, PowerPoints, movies and GIFs are different types of media through which students can learn. They can encourage active participation and allows the teacher to offer personalized assistance when necessary. Ultimately, by using apps the teacher can switch between assignments as needed, reevaluate the class in the moment and keep everyone on task (Van Laar et al., 2017). Therefore, an understanding of communication and collaboration is vital for a PE teacher to ensure proper teaching and acquisition of skills. Effective communication and collaboration can enhance teaching and learning of different motor skills (H'mida et al., 2020). Teacher's verbal and nonverbal communication should also be complemented by timely feedback . This will help students develop motor skills for optimal efficient learning and engagement.

2.4.3 Creation of Digital Content

Digital content creation is the process of content creation based upon topics meaningful to a target audience and put into either written or visual conceptual development. The goal is to make content and information accessible to users/readers (Drotner & Schroder, 2010). Xie et al. (2017) suggested that learning content in today's digital age encompasses a collection of complex materials and interactive features like embedded quizzes, simulations and videos. Thus, determining whether digital content is age-appropriate becomes exceedingly challenging and ultimately, schools will determine which digital resources are useful without considering learners need. This is particularly true for teachers who are not trained and equipped to evaluate, choose and integrate effective digital resources into their pedagogy (Johnson et al., 2016). It is not as simple as giving every classroom a device ; it requires a totality of effort from trained educators with access to effective content.

A study by Reyna et al. (2018) stated that using apps in every lesson is another excellent method to improve physical education online classes. These apps will also help enhance transition times so that students do not have to wait for another lesson. When asking questions about body control or skill development, visuals are much needed for students of all ages—for example, using the Plickers app (Kent, 2019). The Class Dojo software is a fantastic tool for tracking student behavior and involvement while communicating with parents. During class, the teacher can award points for completing the task, participating, being respectful, or performing actions the teacher considers suitable. They can also deduct points for activities unrelated to the work at hand.

On top of that, the teacher can invite families to receive notifications once they are available, which can be a helpful way to communicate with families regularly. Moreover, using apps allows the teacher to transition from one assignment to the next smoothly. Therefore, the creation of digital content is one of the constructs that help to measure online classes more effectively.

Besides that, digital content can facilitate students' learning of motor skills by providing interactive simulations, instructional videos, and virtual demonstrations that offer visual and auditory cues, thereby allowing students to observe and practice movement techniques dynamically and engagingly, which enhances their comprehension, retention, and application of motor skills (Calvani et al., 2012). In short,

PE teachers need to master creating digital content because it enables them to effectively use instructional videos, interactive simulations, and virtual demonstrations to enhance student engagement, facilitate skill acquisition, and provide personalized learning experiences tailored to individual student needs and learning styles (Quennerstedt, 2019).

2.4.4 Security

Digital skills may be linked to the quality and type of internet connectivity available. (Matías Dodel, 2015). Sánchez-Cruzado et al. (2021) indicated that every priority includes the preservation of digital identities, digital content, personal data and information, security measures, and responsible and safe technology use. Even if both teachers and students can benefit significantly from online learning, strengthening cybersecurity defences is more critical than ever to counter new and emerging threats. Therefore, to incorporate these technological tools as teaching materials into their everyday practices, educators need to recognize that security is a component of digital skills. (Dodel Matias & Mesch, 2018). Besides that, research by Van Deursen and Van Dijk (2014) found that seniority online is defined as the length of time a user has had to develop online habits and assets, including digital security skills. In other words, the more time they spend online, the more likely they are to create proper digital social skills and acquire the skills needed to engage in active cybersafety behaviour. Similarly, users are exposed to a variety of platforms and interfaces, and the variety of devices from which they access the Internet has a positive impact on their digital socializing and education (Van Dijk, 2006).

The Microsoft Global Threat Activity Tracker recorded more than 8 million malware incidents from July to August 2020, with the education field being the most affected industry. As a result of the recent rush to implement e-learning, the area has become more vulnerable to cyberattacks, where cybercriminals exploit possibilities to scam schools, steal critical information, or extort money through ransomware schemes. Indeed, the FBI's Internet Crime Complaint Centre (IC3) recently issued a public service alert warning that hackers are taking advantage of the shift to online learning by increasing their targeting of virtual settings, including those used by schools. Hackers can now access classroom data by intercepting it in transit. By encrypting the data, PE teachers can keep cybercriminals from stealing the information they send and receive.

Schools' cybersecurity safeguards are almost certainly already in place to protect users. Finally, any incidents should be notified to IT/Cybersecurity. One should always log off when leaving the computer and never write down the any password or engage with someone that might see the password. As hackers continue to break boundaries and expose newly established threats and vulnerabilities, PE teachers, parents, and students need to be update to protect their hardware and identities.

Safe and ethical use is necessary in the use of digital skills. As digital citizens, PE teachers can create a "safe and respectful environment" (López-Belmonte et al., 2019) for themselves and their students. Furthermore, the more digital skills PE teachers have, the more likely they are to integrate digital resources into the classroom and developmentally appropriate challenges and support more diverse student needs through technology applications in their daily routines.

Digital skills connected to physical education helps improves the quality of instruction. The more streamlined administrative functions (digital platforms) that act as substitutions in the educational environment (Koekoek & van Hilvoorde, 2018), the more collaboration among educators, access to digital resources and materials, and a better chance that students learn about their fields of interest. All of these demand digital skills and expertise.

2.4.5 Problem Solving

Digital problem solving skills involve defining and solving problems via ICTs. Problem solving is the identification and application of new knowledge to situation that necessitates concrete investigation to find a solution. (Mainert et al., 2019).The indices of problem-solving skills refer to the extent to which someone can recognize, propose, and explain possible solutions, as previously indicated (Kauffman et al., 2008). Individuals and teams can use problem-solving abilities to learn and apply the knowledge needed to solve challenging problems at work (Mainert et al., 2019). As the number of occupations that require workers to solve complex problems in real-time rises and the number of positions that require workers to adhere to clearly defined organizational procedures and routines falls, problem-solving skills are likely to become increasingly important (Autor et al., 2003). Given the growing reliance on the Internet as a source of information, using online data effectively is critical to developing viable solutions to the problem (Laxman, 2010). Where physical education is

concerned, PE teachers both create and meet challenges with technology, ranging from basic digital troubleshooting to more advanced complications. Physical education would facilitate the matching of challenges to potential solutions, personalization of instruments for individual need, a better analytical approach to digital instruments and solutions, and a greater understanding of personal need through resources, instruments, and competence development. Therefore, the use technology as a problem-solving approach will assist PE teachers by encouraging unconventional means of thinking, collaborative approaches to digital and media construction, construction and implementation of digital expression via digital media and instruments, problem solving via content knowledge and conceptual understanding, assessment of personal proficiency, ability to help others with their proficiency, and awareness of up-and-coming developments.

2.4.6 Teaching, Learning, and Assessment

Teaching, learning and assessment of digital skills in physical education encompasses the use of technologies that foster state-of-the-art and interactive classrooms to provide meaningful learning experiences and promote physical activities. (Kirschner & Davis, 2003).

In addition, digital skills are prerequisite for PE teaches as it helps them assess and apply proper teaching, learning and assessment using digital application. Moreover, digital skills may help teachers offer personalized learning and differentiated instructions based on student interests and needs for optimal learning and supportive environments. Teaching, learning and assessment are important since they are the foundation by which standards are applied to teach students the required skills and concepts needed for appropriate physical growth. In this sense, digital tools in teaching, learning and assessment can be used to help students being fit, healthy and to promote a healthy lifestyle.

Teaching, learning and assessment are inextricably linked for student success in physical education. For a physical education teacher to successfully teach, she must assess how students learn best and implement lessons that effectively integrates various learning styles, needs and abilities of the students. Therefore, the most effective approach to teaching will not only empowered students with abilities for physical activities while equip them with responsibility, teamwork and a multitude of other

interpersonal and intrapersonal skills that position the student for success inside and outside of the physical education classroom. Furthermore, assessments have benefits for the teacher and students. PE teachers conduct both formative (assessment during lesson to appreciate effective mastery) and summative (assessment post-lesson to document effective mastery or lack thereof) assessments to document performance and to pinpoint areas that need reinforcement (as practice) what the students have acquired need to teach) or what needs to be adjusted in real time for effective learning.

Furthermore, continuous assessment will also benefit the PE teacher as all students will be evaluated and this data can help facilitate a differentiated learning experience. For example, fitness assessments to gauge a student's baseline versus their potential in endurance, strength and flexibility improvement; and skill assessments to gauge a student's baseline skills in various sports and activities to determine potential averages with student needs. This is important to plan lessons that are adjustable to personal speeds to create meaningful learning moments that build confidence and goal setting inside and outside the classroom. Furthermore, this can be administered after lessons to inform students where they stand in the process and how to better learn.

Most importantly, the notions of teaching, learning and assessment go beyond the classroom. It extends beyond such confines, meaning that PE teachers assist in the development of lifelong fitness and wellness by encouraging lifelong positive associations with physical activity that exists beyond the classroom and into adulthood. PE teachers who successfully teach and assess teach students what they need to know for becoming competent, confident adults going forward, applying what they learn in the PE classroom to any environment that fosters a healthy body and mind. Thus, teaching, learning and assessment, therefore, are both required for classroom success but also success beyond school walls as sustainable lifestyles.

A digitally competent PE Teacher, must be aware of information data literacy, digital content creation, communication, collaboration, security and problem solving and all are related to establishing a contemporary, engaging and supportive learning atmosphere where student needs are diverse. Digital competence is essential for a positive atmosphere that supports lifelong fitness and wellness because this ensures a safe space for proper teaching in which assessment occurs at any time and progress can be monitored.

In today's digitally driven educational landscape, PE teachers must possess a wide range of digital skills to keep pace with their students' evolving needs. Data

literacy is an important skill since it allows physical education teachers to gather, interpret and understand information regarding student performance, health and fitness. Fitness trackers and apps give PE teachers real time observations and show trends of student achievement, allowing data collections, and design of individualized learning plans and each student. Therefore, a PE teacher's digital skills extend the learning space for the learner but also in compiling data to assess where students need additional focus, where they are performing, and what is specific and measurable for future lessons with goal driven intentions.

Just as important is collaborative and communicative skills. There are countless digital resources for communication, and these resources can be included in the classroom to help PE teacher connect better with students, with other teachers, with departments, other schools and with the community . For instance, using digital message boards or classroom comment boards, a PE teacher can easily clarify questions, acknowledge milestones (day-to-day or week-to-week developments) and keep students invested in a health/exercise topical project. Digital document sharing and collaboration (group presentations or sport/game suggestions for the season) create an increasingly inclusive classroom environment for all students as it's best to work collaboratively on research or simple recommendations given to PE teacher as a request for attention to emphasize teamwork, peer-to-peer learning and a more supportive classroom environment.

Another critical component of digital competencies is security issues as they affect student data and privacy within the classroom. A PE teacher will need to understand data security and use it when appropriate, assess how/where information will be distributed/stored, and think about the privacy levels that may need to be respected due to the multitude of applications and sites digital citizens can access. If information is left unsecured, or children are allowed to become victims of cyber intrusions, where the PE teacher is concerned, then the PE teacher has not provided fair, secure, and respectful digital competency in the classroom. Furthermore, security issues are part of parcel of digital citizenship and it can be taken advantage of. This reflects the need for safety in digital utilization.

Ultimately, critical thinking skills linked to problem solving are essential to keep abreast of the constantly changing technology and digital resources. Teachers must be adaptable and use problem solving to get through digital learning. Whether it's malfunctions in technology, new ways to engage with students, or lesson accessibility,

the more problem-solving skills a teacher has, the more adaptable and pedagogically open they will be. Furthermore, the more critical thinking skills they have in relation to varying needs, the easier it will be for them to implement technology when it's essential, and make lessons even more engaging.

Ultimately, the assessment aspect of digital teaching implies taking usually sport or field related practices and bringing them to an online platform. This is digital assessment, digital feedback and performance breakdowns for continued student development and reformed in-class teaching. Knowing how to navigate assessment tools online will empower the PE educator to provide better and more frequent feedback to teach students during the process which will create a safe and comfortable space for them to learn, acquire, and maintain information. In addition, this will allow PE teachers to take the subject beyond the classroom walls, creating an easier transition for students into a digitally modernized world where digital accessibility and physical wellness go hand in hand.

Ultimately, digital literacy makes for improved instruction and rapport building to equip students with the knowledge and tools needed to achieve their future health and fitness goals. Therefore, technology with comprehensive yet applicable approaches to digital literacy make for a better, more engaging, more impactful learning environment for every 21st century student..

2.5 The Level Between Digital Skills and PE

According to prior research, they have foundational digital skills in creation and resolution regarding physical education (VarelaOrdorica & Valenzuela-González, 2020; Rodríguez-García et al., 2019; Antonio-Manuel RodríguezGarcía et al., 2019; Almenara & Gimeno, 2019; López-Belmonte et al., 2019; Llorente & Iglesias, 2018). Research has found that ICT use in educational practice is still far from ideal. This is because many teaching processes, including technological tools, do not provide clear and accurate evidence of innovation or increased learning compared to traditional teaching and learning methods (Fernández-Gavira et al., 2021). Furthermore, new technologies are frequently integrated without a well-founded educational strategy that is centered on the transversality of ICT. Moreover, teachers do not receive the appropriate training to carry out this process (Pozo-Rico et al., 2020). As a result, only

minor changes in teaching and learning occur, as both teachers and students are accustomed to traditional teaching approaches.

To a smaller extent, studies on active teachers found that they lack sufficient digital skills to meet the current demands of the information society (Chandrasena Rajeswaran, 2019; Loureiro & Rodríguez, 2019), particularly in areas like information literacy (Trujillo-Torres et al., 2020; Nowak, 2019) and content creation (Chandrasena Rajeswaran, 2019; Loureiro & Rodríguez, 2019; Amhag et al., 2019; Del-Moral-Pérez et al., 2019). Other studies report that appropriate levels of teacher digital skills are complicated by limited number of computers, non-tech savvy educators, and expensive communication fees (De la Calle et al., 2021). By contrast, other studies solidify appropriate levels of teacher skill with a focus on collaboration and communication (Le et al., 2018).

The response to the level of teachers' digital skills in Malaysia is categorized in varying levels of good, fair and poor. This means that many teachers can navigate digital systems and utilize them to advance their educational efforts, but also means that there are some teachers who have not yet been trained or even granted the opportunity to be effectively trained. Those with lower skills should be given the same opportunities as those with higher skills to ensure a more homogenous teaching and learning classroom as digital usage becomes more normalized in present-day society (Sufian et al., 2020). Among the variables considered in previous studies on variables predicting digital competences acquisition there are those from a non-informative age (Artacho et al., 2020) as well as training, type of institution and teaching experience of PE teachers (Hinojo-Lucena et al., 2019). As for the variable of gender, male teachers have more knowledge of ICT; female teachers are more creative in the development of digital products (Vázquez-Cano et al., 2017).

Teachers' perception of the need to use digital elements in an educational framework was confirmed by international surveys, the international adult assessment program (PIAAC) and the international study of teaching and learning (TALIS). It's reported that teachers recognize the need to use digital technologies within an educational context (Hämäläinen et al., 2021). As for teacher comparison skills, 42% of teachers reported a gap in their digital competences while 84% report an adequacy of work performance skills; 11% report adequacy of survival skills and only 12% report proficiency. Seniors are more often in a skills gap situation, however, nearly half of the educators allowed for ICT usage in classroom settings meaning that where they were

teachers were generally positively aligned about digital elements (Serezhkina, 2021). Several sociodemographic characteristics have been discovered to influence digital skills in the previous study. Researchers agreed that young people generally have better digital skills, including specific digital information skills, than older people (Drotner & Schroder, 2010). Prieto et al. (2020) further noted younger teachers are more interested and knowledgeable in the use of ICT than older teachers.

In the near future, teachers who are not capable of using ICT in physical education classes may face difficulties in teaching as they get older. Husain et al. (2015) mentioned that older teachers tend to have less experience and skill in using technology. They may feel discomfort or unfamiliar with new technologies, limited professional development opportunities to upgrade digital skills, and less exposure to newer teaching methods that adopt digital tools. Teachers advancing their careers without adequate support or recognition of ICT capabilities may revert to traditional teaching methods or rely less on ICT, limiting the integration of digital tools into PE lessons.

Greve et al. (2020) study focused on the direct relationship between PE teachers' digital skills and students' performance and examined the extent to which students have acquired digital skills. Another study by Guillén-Gámez et al., (2020) probed into teachers' attitudes or predispositions toward the use and pedagogical use of ICT in the classroom are linked to their knowledge and level of competence. In this way, attitudes, beliefs, and interest in ICT can be used to predict teachers' use of digital skills (Tirado-Morueta & Aguaded-Gómez, 2014).

Physical education has been particularly affected, indicating that what is said, written, and done in its name defines it (Coulter & Ní Chróinín, 2013). Physical education has traditionally been a practical and "hands-on" subject in schools, where a personal approach and physical contact are commonplace. Previous research also showed that the subject has changed over time and that its temporal situation has changed (Varea et al., 2022).

To put it briefly, when new technologies are used in physical education, digital skills are essential for the teacher (Rojano Ortega, 2015). It is also important to note that digital skills are compulsory in the education curriculum, as they are a fundamental skill. Referring to the research by Lohmann et al. (2021), teachers should engage in continuous professional development, as the integration of ICT, particularly in physical education, is highly dependent on teachers and their digital skills. Other researchers have also mentioned the challenges in implementing these digital skills in physical

education classrooms (Varea et al., 2022). For example, in Spain, due to the COVID-19 pandemic, the delivery of physical education has shifted entirely to online mode, which could have severe implications for the quality of PE teachers' teaching (Varea & González-Calvo, 2020). Teachers also struggled to connect their physicality with the new version of physical education with digital skills, which can either enhance or limit their alignment with the latest physical education syllabus (Kirschner & Davis, 2003). Furthermore, direct instruction and teacher demonstration are essential for students' learning.

A study by Varea & González-Calvo (2020) found that teachers are more familiar with the conventional pedagogical approaches they used when they were students. Thus, it is essential to note that if teachers do not receive training in new technologies, it will be difficult for them to integrate ICT into their classrooms. Furthermore, they cannot support the development of digital skills in physical education (Greve et al., 2020; Kretschmann, 2015; Rojano Ortega, 2015).

As a result, the overall goal of this study is to examine teachers' perceptions of digital skills at the physical education level, considering six essential variables: information and data literacy; communication and collaboration; digital content creation; security; problem-solving and teaching; and teaching, learning, and assessment, especially in Selangor.

2.6 The Difference between Genders in Digital Skills

Gender differences in digital skills can be observed in different ways. In this light, these differences can be linked both societal norms and individual preferences. Husain et al. (2015) found that men are typically more knowledgeable in the technical aspects of digital technology such as in coding, software development, and hardware management. Likewise, women demonstrate the tendency to master communication-oriented skills, including digital communication, collaborative online tools, and social media. A study by Hämäläinen et al. (2021) observed that male PE teachers are typically more knowledgeable on digital technologies and use digital tools more often in their classrooms than female teachers. Female educators were at greater disadvantage, as well, when it came to device utilization. Reported by Kim et al. (2021), levels of digital competence between male and female PE educators vary considerably with male educators having more honed abilities. There are many factors that contribute

to this, from educated exposure to socio-culturally expected roles to personal interests. However, this implies that digital competence should be universal among genders to make use of differing abilities and interests (Dodel Matias & Mesch, 2018).

2.7 The Difference between Rural and Urban Areas in Terms of Digital Skills

There are many determinants that exacerbate the digital skills gap between the two populations. For example, urban populations have more access to online resources by way of the internet which means that digital literacy workshops in person are more convenient for urban residents to gain higher levels of digital literacy. In addition, Loureiro & Rodríguez (2019) found that higher level internet speeds and infrastructure help with additional online work whereas rural populations have slower internet access with less reliable infrastructure which fails to support those interested in bettering their digital skills. In addition, rural populations inherently have fewer resources per capita, meaning that fewer digital skills development opportunities exist by way of specific courses that include literacy on computers, engaging applications and online forms of communication. Looker & Thiessen (2003) support this by noting access to fewer resources entails lower levels of educational achievements compared to urban peers. Chama & A. (2023) validate this finding noting that improved digital literacy resources in rural areas would be good with equitable vocational and supportive opportunities for all PE teachers regardless of location with any developed digital skills.

Where digital skills disparities are concerned, socio-economic development considerations are critical. This means that urban residents have additional employment opportunities per accredited digital skills and for rural residents who possess basic digital skills, there are still limited entry level opportunities. Where interventions are concerned, improved access to internet connections for rural populations and general programs that expand digital literacy that champion the urban-rural gap are necessary (Wang et al., 2020).

2.8 Self – Determination Theory (SDT)

The Self-determination theory (SDT) is be applied to determine Selangor PE teachers' digital competence. According to self-determination theory, a macro theory of motivation, people have an innate propensity toward independence, competence and

social connection (Deci & Ryan, 2008). SDT includes three psychological needs: autonomy (i.e., sense of control of one's own behaviours and goals), competence (i.e., sense of effectiveness in goal achievement), and relatedness (i.e., sense of connection and engagement). Relative to the ability to support the development of internal regulation to help teachers face new challenges in understanding digital competence, all three psychological needs united across a group is positive for awareness and emergence of internal regulation for self-governance (Deci & Ryan, 2008; Vanslambrouck et al., 2018).

However, if any one of the three psychological demands is not met, it may result in apathy or in the need for external motivation. Due to social distancing policies and pandemic lockdowns, teachers were forced to teach virtually. This could lead to a lack of interpersonal interactions and feelings of social disconnection and isolation, which could be exacerbated in digital environments, discouraging students from participating in online learning (Liguori & Winkler, 2020). According to Self-Determination Theory (SDT), digital competence is defined as "competence" in this study. The constructs are illustrated in Figure 2.1 below (Deci & Ryan, 2008).

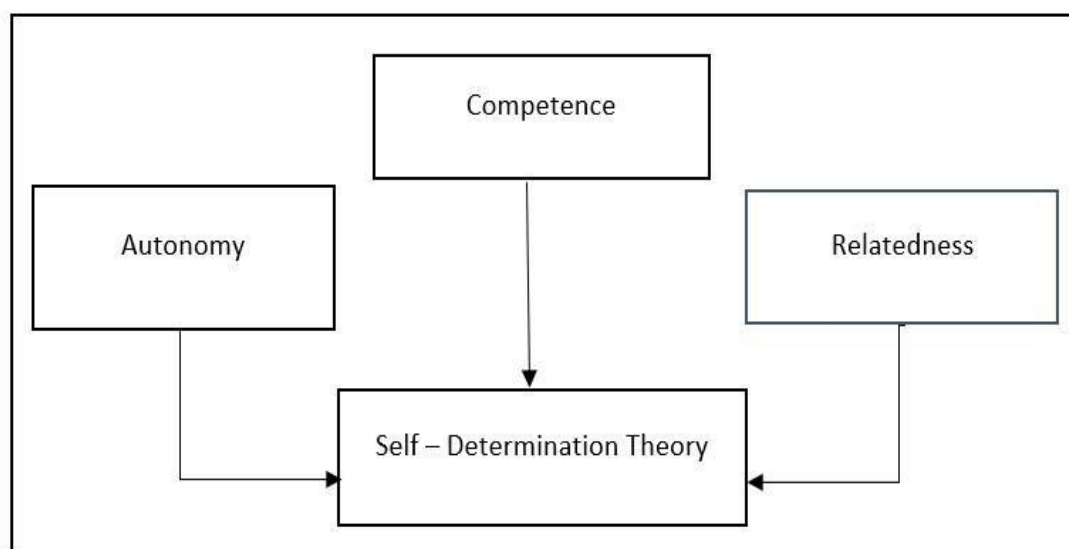


Figure 2.1 Self – Self-Determination Theory

(Deci & Ryan, 2008)

Chiu (2022) listed the contributions of SDT. The study aimed to understand the meaning of digital competence in online education during the COVID-19 pandemic. Past studies have primarily focused on the measurement and role of digital skills in

academic performance, but little attention is paid to its potential in maintaining teachers' mental and emotional health, an essential aspect both during and after the pandemic as students return their usual schooling routines (Pozo-Rico et al., 2020). SDT offers a new perspective on digital competence due to the consideration of teachers' psychological well-being in online learning. Sørensen et al. (2009) further argued that including basic psychological needs and intrinsic motivation can help determine whether teachers want to use e-learning in their classrooms. The study examined links between basic psychological needs, degrees of involvement, emotions, and emotional tiredness and learning. Klassen et al., (2012) mentioned that teachers who got their need fulfilled for relatedness by engaging with students had better engagement, demonstrate more positive and less negative emotions compared to those who gain relatedness by engaging with colleagues. Moreover, Chang et al., (2017) posited that internal motivation and desire to accept and repeated use of e-learning are positively influenced by competence and perceived autonomy.

Self-Determination Theory (SDT) presents a psychological framework emphasizing human motivation. It focuses on the factors cultivating one's intrinsic motivation and well-being. In the case of PE teachers, SDT provides insights into how teachers' motivation influences teaching practices, interactions with student, and professional development.

The key concepts of SDT that are relevant to PE Teachers are as described below,

2.8.1 Basic Psychological Needs

According to SDT, there are three fundamental needs linked to motivation: autonomy, competence, and relatedness. These needs are manifested among PE teachers as exemplified below,

2.8.1.1 Autonomy

Autonomy is when PE teachers are given the freedom to design and implement their teaching methods, such as by incorporating digital tools or gamification in ways they find compelling. For example, PE teachers might use heart rate monitors during endurance training and gamification platforms like Quizizz for theoretical components.

This sense of freedom and autonomy helps PE teachers design lessons to increase their students' intrinsic motivation. Thus, in promoting autonomy among PE teachers, the government or relevant parties should provide professional development support, such as workshops (e.g., digital tool training and strategies for inclusive PE instruction), to help them enhance their digital literacy skills in the classroom.

2.8.1.2 Competence

Competence is when PE teachers are motivated because they know they can apply what they've learned to their lessons, teach diverse student populations, and utilize technology to ensure learning objectives. For example, a PE teacher attending an out-of-school workshop learns how to use a fitness tracker to measure student engagement and activity. If it's effectively integrated into the classroom, they feel competent and empowered by student achievement. Another example includes PE teachers who accumulate data of the steps taken during an outdoor lesson and discusses this data with the students. Such competence improved PE teachers' perceptions of their own competence. One way to support this competence for PE teachers would be a mentorship opportunity with other PE teachers who have such advancements, perhaps bringing new technology to the forefront. Other teachers could use MyFitnessPal or FitNotes in collaboration with other teachers.

2.8.1.3 Relatedness

Social relatedness where PE teachers connect with students and other teachers satisfies a socially meaningful interaction that drives their motivation to create and learn new PE effective strategies. Self-Determination Theory (SDT) outlines intrinsic and extrinsic motivation. Both facets are tied to PE teachers' implementation of technology in the teaching and learning process. For example, PE teachers establish a community of practice to share challenges and successful approaches to teaching that make them feel like they belong. A teacher feels valued when their innovative use of gamification is recognized in a staff meeting or professional conference. To promote relatedness, schools or the Ministry of Education (MOE) can organize regular forums for PE teachers to share success stories and collaborations and provide professional peer support.

The use of SDT in assessing the level of digital skills among PE teachers is essential as it relates to two types of motivations (i.e., intrinsic and extrinsic). Motivation is a necessary factor in ensuring a person remains actively involved in something. PE teachers are intrinsically motivated by the enjoyment of the teaching process, the subject of physical education, and the content of health and fitness-related materials. As such, they establish a solid and interactive classroom. However, teachers may also be motivated by externalized constructs - such as school requirements or evaluative parts - but it depends on their internalization in the teacher-learning process. For example, a teacher must attend professional development sessions as a mandated part of their teaching career; however, if the teacher views this opportunity as something that will benefit him personally instead of a mandated, tedious task, he will probably pay more attention.

According to Guo et al. (2023), students' motivation and engagement levels in PE were vastly heightened when teachers created an autonomy supportive approach to teaching. This is essential because teachers feel motivated and competent about their strategies. According to Tessier et al. (2010), teachers with better motivational approaches lead to better student outcomes. Thus, professional development strategies which reinforce teacher perceived competent motivated teaching strategies yield better outcomes. When teachers feel competent, they're more likely to try new avenues. Cox & Ullrich French (2010) explored the importance of relatedness support where PE teachers with their own colleagues and administrative support in a relatedness atmosphere are more likely to create a supportive atmosphere for their students. The results are indirectly related to SDT and PE Teacher's Development of Digital Competence, and PE Teacher's Development of Digital Competence takes an indirectly relevant approach to this study as well because these findings essentially offer many suggested implications for increased motivation for PE Teachers to utilize digital competencies in teaching and learning, as listed below

a. Collaborative Planning

Collaborate with PE teachers for curriculum and technology implementation. For example, allow teachers to choose whether they want to use technology for fitness assessments, gamification or sports statistics.

b. Flexible Implementation Policies

Make tools optional to support exploration. For example: When presenting a new tool, offer a variety of interchangeable options. For instance, if a new app is created, offer Strava or Fitbit or Google Fit as the apps available and the PE teacher will determine which one works best for them.

c. Targeted Professional Development

Offer workshops that focus on digital skills, classroom management, and digital teaching strategies. Example: Host a session on using video analysis software like Hudl Technique to improve students' performance in sports.

d. Recognition Programs

Celebrate teachers' successes in integrating technology or innovative strategies in PE. Example: Highlight a teacher's use of a fitness tracker to improve students' engagement in a school newsletter or meeting.

e. Peer Collaboration Opportunities

Create platforms for teachers to connect, such as team teaching or peer coaching. Example: Paired teachers should share similar interests to co-plan, design, and develop lessons or share teaching resources.

f. Student Engagement Initiatives

PE teachers should be encouraged to involve students in planning activities. Example: Allow students to suggest sports or activities they would like to learn as a way for teachers to connect with their students' interests.

In conclusion, the emphasis on the concept of Self-Determination Theory, which is motivation, can help teachers to continue to be actively involved in the use of digital technology, especially PE teachers, because the challenges and obstacles faced by PE

teachers are quite challenging in ensuring the three domains namely psychomotor, cognitive, affective are achieved during the teaching and learning process in the classroom.

2.9 Technology Continuance Theory (TCT)

This study used Liao, Palva, and Chen's Technology Continuance Theory (TCT) (Liao et al., 2009). The TCT theory of Liao et al. (2009) was extended and modified to meet the study's needs. According to TCT theory, the level of a user's digital skills, which are information and data literacy, communication and collaboration, creation of digital content, security, problem-solving, and teaching and learning assessment, is influenced by confirmation of expectation, perceived usefulness, and perceived ease of use of Information Technology (IT). When users are satisfied with IT, their intention to continue using technology increases. In the beginning, external variables, such as system design features that lead people to believe in digital skills, will produce specific results. Second, an individual's outcome expectations influence their actual acceptance of the system by causing positive or negative feelings about its use. Third, perceptions of digital skills are compared with expectations after a period of use. The evaluation provides confirmation or disbelief, resulting in a change in the individual's level of satisfaction. Finally, satisfaction levels influence the intention to continue developing digital skills.

To sum up, there is a growing awareness that students are quite ready and able to use systems, technologies, and capabilities as learning tools in educational contexts. For teachers, the extent to which they employ and continue to use technological tools in the classroom is unclear. Their behaviors, attitudes, and perceptions span the entire continuum—from enthusiasm to resistance, from self-efficacy to distaste. Even with various technologies or capabilities accessible, these behaviors and attitudes persisted, depending on the context, topic, concept, student group, level, and access (Wright, 2015). A study by Wright (2015), which applied the Technology Continuance Theory (TCT), found that teachers in New Zealand consider reliable technological tools essential components of teaching and learning. On the contrary, teachers are unlikely to use Internet-based classes, as poor or unreliable Internet connections could hamper lesson delivery, especially when they need to access the Internet, for example, to display a video clip in the classroom.

By using TCT, researchers can identify factors such as unreliable internet access, outdated technology, limited access to tools, firewalls, and the overlaying of digital tool use over unmodified teaching as problems that can affect teachers' digital skills in online teaching and learning, even when it is conducted in the physical context. Therefore, PE teachers need to incorporate digital technology into their classrooms to enhance students' learning. Below is Figure 2:2 The Technology Continuance Technology (TCT) (Liao et al., 2009)

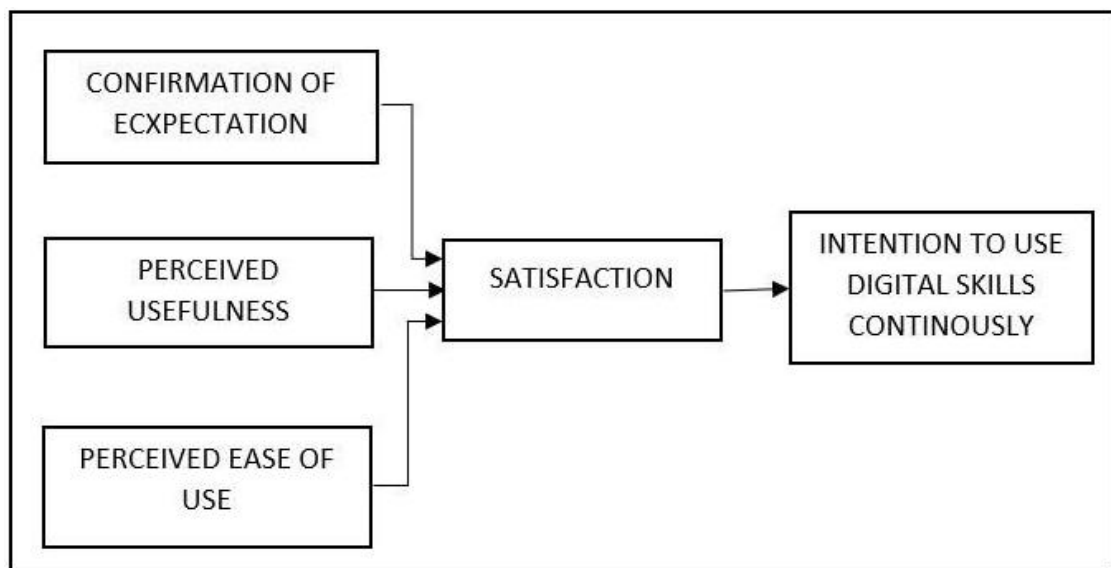


Figure 2.2 The Technology Continuance Theory

(Liao et al., 2009)

Technology Continuance Theory outlines key components that influence technology continuance:

2.9.1 Confirmation of Expectation

Confirmation occurs when a user experiences technology use that aligns with their expectations. Positive confirmation reinforces users' satisfaction and perception of usefulness on intention to continue use. For example, if a teacher gamifies learning through Kahoot and expects that the more students engage with Kahoot and better recall information, the more entertaining PE theory lessons will be, such positive confirmation is expected to increase intentions to continue use.

2.9.2 Perceived Usefulness

Perceived usefulness is a belief that continued use is advantageous. For PE teachers, it's advantageous to their students, or it's a giant time saver. For instance, a teacher believes continued use of Hudl video analysis is useful as students who play sports and then play it back through the recording become better at sports - or so the teacher believes - by replaying what they did during the game.

2.9.3 Perceived Ease of Use

Perceived ease of use will support the digital competences for the PE teacher. It lowers the barriers to implementation. The more tools are easy to use from their perspective, the more research they might conduct on tools that might be helpful but completely unrelated to their lesson plans and apply those skills relevant to the digital competences. The more perceived ease of successfully navigating digital tools, the more likely they are to continue utilizing and expanding upon digital competences. In addition, if tools are easy to use, they're more likely to come back for subsequent professional development trainings and workshops to learn about other tools in which they might not have directly engaged. The more these easy-to-use apps are utilized, the more educated digital competences they will have as they gain additional skills. In addition, perceived ease of use means that there's a perceived support for educational stakeholders that will support the PE teacher with regard to digital competence.

2.9.4 Satisfaction

Satisfaction is also a term to indicate how a particular technology fulfills expectations and needs. For a PE teacher, whether or not technology helps them do their job better - by keeping students engaged and interested or providing a quick and comprehensive assessment tool - makes satisfaction relative. For example, a PE teacher could be satisfied with a digital assessment tool for fitness because it quickly allows them to assess each student's fitness capacity.

Beyond PE teachers' expected satisfaction, high levels of satisfaction induced indirectly based on perceived ease of use and perceived usefulness are effective for continued use of technology by teachers and increased digital literacy for teachers

which subsequently allows the implementation of such an approach for effective teaching and learning. According to Baddar & Khan (2023) and Konukman & Filiz (2024), these are the three most critical determinants for ensuring such approaches in teaching and learning.

PE differs from other curricular subject areas in that theorized concepts and practical application occurs simultaneously. Unique challenges are posed for technology integration and various student needs, time allotted for teaching, and attention span/size of classes. Technology Continuance Theory (TCT) explains how PE teachers can adopt technology use with TCT for sustained implementation for this challenge.

An example of technology that can be used are wearable technologies. Fitness trackers (Fitbit, Garmin, Polar) track heart rate, steps, calories burned, and intensity levels of exercise. Application programs (Strava, MyFitnessPal, Google Fit) help students and educators record exercise and evaluate patterns. These are technologies used by PE educators, but how does TCT ensure PE spans multiple years? In relation to habit formation, the more teachers acknowledge/use fitness data for lesson planning/participation levels/response to these fitness efforts, the more encouraged they will be to continue operating these systems in order to develop good habits. It indirectly supports good habits development.

A PE teacher uses fitness trackers over a cross country running unit and measures the pace and heart rates of each student. This teacher can tailor fitness goals from this information and advocate better life-long learning for continued success. Another technology that can be used in perceived usefulness is Gamified Learning. Gamified Learning is incorporating game-like features into learning experiences and for example, the non-physical parts of PE can be gamified to make it more dynamic and engaging. Gamification can increase levels of attention and interest for students in health literacy, anatomy, or sport tactics. Thus satisfaction from technology use provides teacher acknowledgment from student approval rates and increased interest which leads to teacher satisfaction from daily use of gamified learning.

TCT is an expansive theory that provides useful information as to how technologies affect teachers and it's the only theory that spans the psychomotor, cognitive and effective domains. Four factors support TCT - satisfaction, perceived usefulness, confirmation of expectations, habit formation. These TCT factors will ensure PE educators regularly integrate and use technology in their classroom.

2.10 Previous Studies Related to Instrument Development and Adaptation

There are several published guidelines that can be used in developing and adapting instruments for digital skills. DeVellis (2016) listed a nine steps guideline, Di lorio (2005) outlined six steps for instrument adaptation and McCoach et al. (2013) listed sixteen steps. This study combines all three instruments to develop a new instrument for assessing digital skills among PE teachers. The new guideline, as presented below, combine items from instruments developed by DeVellis (2016), Di lorio (2005), and McCoach et al. (2013).

Table 2.2
Steps That Have Been Combined to Be Used in This Study

No	Steps	Scholars
1	Determine clearly what it is you want to measure	DeVellis (2016)
2	State the theoretical definition	DiLorio (2005)
3	Identify the dimensions of the concept	DiLorio (2005)
4	Write items for each content domain by concept dimension cell in the matrix.	Dilorio (2005)
5	Write the rules for the scoring and administration of the scale.	DiLorio (2005)
6	Expert review	DeVellis (2016)
7	Pre-pilot testing	McCoach (2013)
8	Pilot study	DeVellis (2016)

DiLorio's process is advantageous. This is due to its focus on real-world applicability and practical relevance in health-related research. The instrument should be parallel with specific needs of the target population's and study context (Di lorio, 2005). DeVellis' (2016) criteria for item development and validation are comprehensive and systematic, theoretically and psychometrically, and include all steps necessary to develop items and test for validity and reliability. Other criteria for item development and validation did not pre-pilot test items for validation as McCoach et al. (2013), but since it includes relevant criteria for cognitive interviewing. Therefore, the researcher relied on all three sets for a measure of relevance, DeVellis (2016) for inclusion of the rigorous psychometric testing. Thus, the researcher employs this comprehensive set to maintain theoretical integrity, real-world relevance, and practical testing.

The 10 combined steps were taken from the prior studies . The first step is to establish a theoretical definition, which is a systematic review of the literature in search of an appropriate theory to support. A theory is formed to generalize ideas and predict or theorize the relationships between those ideas.. This theoretical framework allows the researcher to describe the meaning, nature, relationship, and challenges associated with a phenomenon in the context of education or social sciences. The second step is to identify the dimension of the concept that is related to the research framework.

Meanwhile, the third step is to create a content domain using a concept dimension matrix that illustrates the material to be addressed by the items and the dimensions of the concept to be measured for each item generation. The fourth step is to decide how many items to include in each cell of the matrix. The matrix helps the researcher visualize the concept's dimensions and content domains. It also allows the researcher to determine the quantity and type of items needed to assess the nation properly. The fifth step was to write items for each context domain by concept-dimension cell in the matrix. The matrix helps the researcher establish the content sections and the number of items to write. In the sixth step, rules for scoring and administration, such as the Likert Scale, were determined. The Likert Scale is commonly used to assess beliefs, opinions, and attitudes in the affective domain (DeVellis, 2016; Kalkbrenner, 2021; McCoach et al., 2013). The seventh step is expert review. According to DeVellis (2016), experts will provide feedback and recommendations to revise the items, improving their quality and alignment with the construct being measured and ensuring content validity, clarity, and relevance. The eighth step is to do the pre-pilot testing. The procedure for pre-pilot testing involves administering the instrument to a smaller sample of the study, including both demographic and scale items. It is an essential step in cognitive interviewing of the item towards the sample that the instruments want to use. The last step is to run a pilot study. The procedure for conducting a pilot study involves administering the refined instruments to a larger sample to evaluate reliability, validity, and overall performance.

Therefore, these guidelines outline the steps the researcher followed in this research to develop an instrument to assess digital skills among PE teachers in Selangor.

2.11 Conclusion

In conclusion, this chapter has reviewed past studies regarding digital skills, physical education, the concept of digital skills in physical education, theory, and the instrument development process. Hence, there is a need to develop an instrument to assess PE teachers' digital skills, as the world's education and workforce are shifting toward technology.

CHAPTER 3

RESEARCH METHODOLOGY

This chapter provides an outline of how this research was conducted. This study's objective is to develop a valid and reliable instrument to assess the level of digital skills among PE teachers in Selangor and to explore the influences of gender, age, and location. This chapter is divided into several sections, describing the research design, conceptual framework, instrument development process, population, sample size, sampling technique, measurement, data collection, and data analysis.

3.1 Research Design

A research design provides a guideline on how the research will be done. Thus, it outlines how data will be collected, analyzed and interpreted to fulfill the study objective. Essentially, a well-developed research design helps to ensure findings are valid, reliable, and relevant to the research objectives (Varela-Ordorica & Valenzuela-González, 2020). There are 3 types of research methodologies, qualitative, quantitative, and mixed methods, a combination of qualitative and quantitative.

Qualitative research focuses on examining and understanding participants' perceptions, experiences, and viewpoints. Qualitative research is largely focused on interpreting meaning, purpose, and the essence of reality (Almeida et al., 2017). Qualitative researchers observe elements within their authentic environments, aiming to understand or interpret phenomena based on the significance individuals attribute (Rahman, 2016).

In the meantime, quantitative research is more objective. A qualitative study should have objectivity, replicability, and generalizability. They also tend to assume the existence of a singular "truth" independent of human perception (Mohammad-Zyoud et al., 2024). Hence, the main assumption in this approach is that researchers strive for objectivity by separating themselves from personal experiences, perceptions, and biases throughout the study. Thus, quantitative researchers employ tools such as tests and surveys to collect data. They also rely on probability theory to test statistical hypotheses pertaining the research questions. These methods are deductive, and statistical tests are used to make broader inferences about a population.

The distinction between qualitative and quantitative approaches led to the emergence of mixed-methods research. This method combines components of qualitative and quantitative research to fulfil the study's objectives. The beginning of mixed methods can be traced back to Campbell and Fiske's multi-elements, multi-method approach. Mixed-method is often regarded as a relatively modern methodology. Its philosophical and methodological principles have evolved progressively since its inception in 1990s, (Timans et al., 2019).

The aim of this study is to develop an instrument that uses the quantitative method for data collection. It is believed that the use of quantitative methods can improve the findings' reliability and accuracy as minimizes subjectivity and bias through quantifiable metrics and standardized processes (Mohammad-Zyoud et al., 2024). As the sample was randomly selected, quantitative findings can be generalized to a larger population or subpopulation (Almeida et al., 2017) to allow researchers to assess correlations between variables, test theoretical assumptions, and conduct strict statistical analysis and hypothesis tests (Rahman, 2016). This study employed the quantitative method as it is aligned with the aims of this study, which are to determine construct validity of instrument on the level of digital skills among PE teachers in Selangor.

3.2 Conceptual Framework

Figure 1 presents a conceptual framework that describes the study's methodology and the instrument's development process. This study focuses on six constructs: information and data literacy; communication and collaboration; creation of digital content; security; problem-solving; and teaching, learning, and assessment.

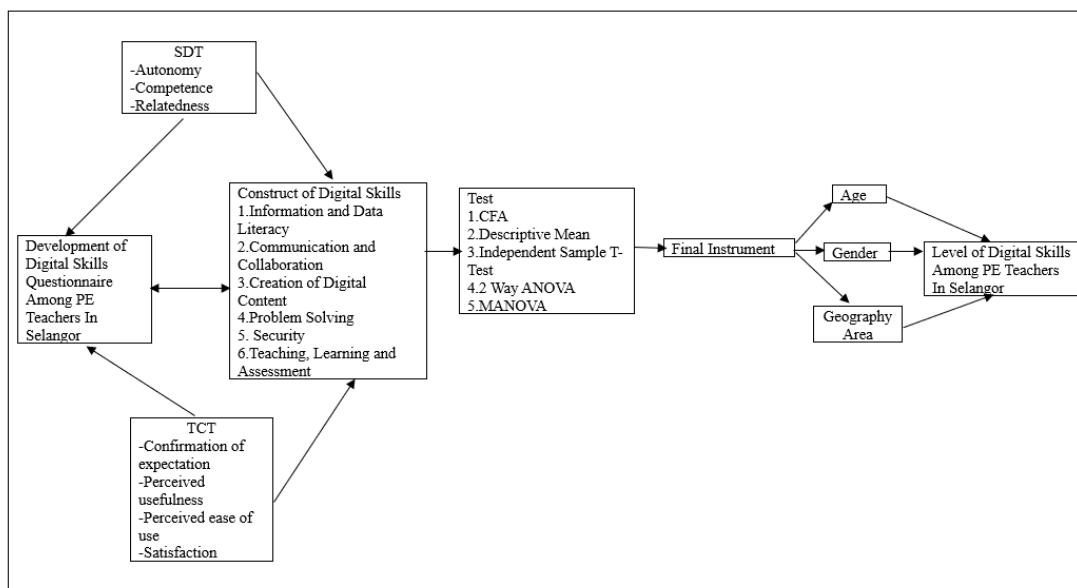


Figure 3.1 Conceptual Framework

A study's conceptual framework provides a theoretical and contextual standpoint for answering the research questions. Thus, in this study on developing the Digital Skills Questionnaire among PE teachers in Selangor, the researcher integrated the Self-Determination Theory (SDT) and the Technology Continuance Theory (TCT) to examine the motivational and behavioural factors influencing technology adoption based on international digital competence frameworks and Malaysian educational policies.

Self-Determination Theory (SDT) and Technology Continuance Theory (TCT) serve as the guiding theories for the development of items across the six constructs. According to SDT, humans have three fundamental psychological needs — autonomy, competence, and relatedness — which influence our motivation (Deci & Ryan, 2000). In this sense, teacher autonomy is the extent to which teachers have their own say in making decisions about planning their lessons—for instance, which digital tools to use and how to integrate them into their teaching. Teachers' sense of autonomy can facilitate communication, collaboration, and the creation of digital content in teaching and learning. In other words, autonomy serves as a booster of dynamic interaction and cooperative engagement between teachers and students. At the same time, it allows teachers to design and implement customized digital learning that fits their instructional goals. Collectively, these interrelated constructs can produce an interactive teaching environment that helps develop digital competencies and supports technology integration. Niu, Lee, and Li (2024) further noted that correlation among these variables

shows the critical role of autonomy in improving digital teaching practices and promoting sustainable educational innovation.

Competence reflects teachers' perceptions of their ability to use digital technologies effectively across interconnected domains, including teaching, learning, and assessment, as well as content creation, problem-solving, and security. These domains are closely interrelated; hence, competence in one area supports and enhances performance in others. When integrated effectively, these competencies enhance teaching efficacy, support personalized learning, and foster professional growth. Empirical findings have shown the importance of a holistic approach in developing these interrelated dimensions of digital competence. This aspect has also been measured using validated frameworks such as DigCompEdu and comprehensive teacher digital competence scales (Siripan & Noirid, 2022; Aydin, 2024)

Relatedness refers to teachers' ability to use digital tools to create and maintain professional and social connections. This psychological need can be fulfilled through creating digital content and providing security. These constructs work together in supporting PE teachers. They can help teachers build meaningful professional relationships and communities of practice, fostering continuous professional growth and enabling effective technology integration. Past studies have also shown that relatedness is linked to digital content creation and maintaining digital security, as it allows PE teachers to connect, share, and collaborate confidently during online and hybrid learning (Tsankov, 2022; Montilla, 2023).

The Technology Continuance Theory (TCT) highlights the factors that determine users' continued use of technology over time. It features our primary constructs — confirmation of expectations, perceived usefulness, perceived ease of use, and satisfaction. This theory posits that these constructs jointly explain users' continued use of technological tools (Liao et al., 2009). Confirmation of expectations is when users' experience with technology fulfills their expectations. The following construct is positive confirmation, which reinforces users' satisfaction and perceived usefulness, encouraging them to continue using the technology. There are four subconstructs: teaching, learning, and assessment; information and data literacy; creation of digital content; and communication and collaboration. In this regard, these constructs promote positive technology experiences, confirm users' expectations, and encourage them to continue using and integrating digital tools (Aydin, Yildirim, & Kus, 2024).

The subsequent construct is perceived usefulness, the belief that prolonged use of technology will lead to tangible benefits. In the context of PE, teachers may perceive technology as helpful as they see how it can improve student learning outcomes or reduce. Perceived usefulness is linked to several key subconstructs, for instance, teaching, learning, and assessment; information and data literacy; communication; and collaboration. These constructs jointly boost the perceived usefulness of technology. This is because they can support teaching processes and increase teachers' efficacy, which, in turn, can motivate continued use of technology. Empirical studies confirm that perceived usefulness, grounded in these interconnected domains, is a central driver of technology acceptance among PE teachers (Rodafinos, 2024; Konukman, 2024).

The following construct, perceived ease of use, reduces barriers to technology adoption, making it an essential aspect in digital skills development among PE teachers. The provision of intuitive and user-friendly digital tools encourages teachers to experiment with and integrate them into their teaching practice. This process is supported by aspects such as teaching, learning, and assessment, as well as information and data literacy and digital content creation. These interconnected constructs facilitate smoother technology adoption by building teacher confidence and competence, thereby reinforcing perceived ease of use, which, in turn, encourages sustained use and the enhancement of digital skills (Koh et al., 2021; Rodafinos et al., 2024).

Satisfaction is another key component in Technology Continuance Theory (TCT). It refers to how well technology meets users' expectations and needs. For PE teachers, satisfaction depends on how technology can help them effectively fulfil teaching objectives, for instance, by increasing student engagement or simplifying fitness tests. Satisfaction is closely linked to constructs such as teaching, learning, and assessment; information and data literacy; communication; and collaboration. When these constructs are aligned, they can lead to positive experiences with technology, create higher satisfaction, and a stronger drive to continue using technology. As shown in empirical studies, the effective integration of these domains led to higher satisfaction among PE teachers when using digital tools, resulting in better instructional quality and student engagement (Cui et al., 2024; Yu et al., 2025).

When combined with Self-Determination Theory (SDT), TCT can offer a comprehensive framework encompassing both the motivational and behavioural dimensions behind PE teachers' digital skills. It ensures that the instrument developed can measure teachers' competence, autonomy, ongoing intention, and satisfaction in

adopting digital technologies for teaching. In conclusion, integrating TCT into the instrument development process provides a strong theoretical foundation for understanding PE teachers' sustained digital engagement, bridging the gap between motivation and long-term technology adoption in educational contexts.

Additionally, based on the literature review, six constructs were identified: information and data literacy; communication and collaboration; creation of digital content; problem solving; security; and teaching, learning, and assessment. Digital skills have also been increasingly recognized as essential for PE teachers globally to integrate emerging educational technologies effectively.

This study used two primary reference models, the Digital Competence Framework for Citizens (DIGCOMP 2.0 and DIGCOMP 2.1) and the European Digital Competence Framework for Education. Both models encompass domains such as information and data literacy, communication and collaboration, digital content creation, problem-solving, and digital safety. Additionally, dimensions related to teaching, learning, and assessment were derived from the Common Framework for Teaching Digital Competence (INTEF, 2017) and The Digital Strategy for Schools (UNESCO). These frameworks collectively guided the selection and organization of constructs for the development of the digital skills measurement instrument.

The first construct is information and data literacy, or one's ability to determine, evaluate, and use digital information effectively. This is particularly important in Malaysia, where the Ministry of Education promotes 21st-century learning skills through critical thinking and digital information management. The second construct is communication and collaboration, which refers to how teachers use digital platforms to engage with students, peers, and the wider community. The shift towards digital learning was intensified during the COVID-19 pandemic, highlighting the importance of this skill, as reliance was placed heavily on platforms such as Google Classroom, Telegram, and Microsoft Teams to sustain interaction (Mastura & Ahmad, 2020). The third construct is creation of digital content, which refers to teachers' ability to design, modify, and disseminate educational resources in digital formats. For PE teachers, this may involve creating interactive workout videos, gamified activities, or digital assessment tools. The next construct is problem-solving, which highlights the capacity to address challenges using digital solutions, such as adapting lessons for students with limited internet access or employing hybrid teaching strategies in resource-constrained schools. Next, security underscores the need for the safe, ethical, and responsible use of

technology, especially given concerns about student data protection and cyber safety in Malaysian schools (KPM, 2021). Finally, teaching, learning, and assessment integrate all these dimensions by examining how teachers employ digital tools to plan, deliver, and evaluate instruction. This construct reflects the aspirations of the MEB (2013–2025), which envisions ICT as a tool not only for administrative efficiency but also for pedagogical innovation.

Demographic factors such as age, gender, and geographical area are also considered, acknowledging their influence on teachers' digital competence, based on six constructs: digital skills; information and data literacy; communication and collaboration; creation of digital content; problem-solving; and security, teaching, learning, and assessment. The researcher adapted and synthesized constructs from established digital competence frameworks to identify the key components of digital skills relevant to Physical Education teachers.

Age has been widely studied as a predictor of digital readiness, with younger teachers typically demonstrating higher confidence and proficiency due to greater exposure to technology from early stages of their careers. Gender differences have also been reported in the Malaysian context, with some studies suggesting that female teachers may demonstrate a higher level of pedagogical application of ICT. In contrast, male teachers often report higher confidence in technical aspects (Rahman et al., 2019). Geographical location further adds complexity, as urban schools in Selangor tend to be better equipped with ICT infrastructure. In contrast, rural schools face barriers such as limited internet access, fewer devices, and lower levels of institutional support (Zaid & Ismail, 2021). Recognizing these demographic factors provides a more nuanced and equitable understanding of digital competence across diverse groups of teachers.

The development of the Digital Skills Questionnaire follows rigorous psychometric standards. Confirmatory Factor Analysis (CFA) is employed to ensure that the questionnaire accurately measures the intended constructs, while descriptive statistics provide a snapshot of overall competence levels. Inferential statistics further enrich the analysis: independent-samples t-tests compare digital skills across gender, two-way ANOVA examines interactions among demographic factors such as age and geography, and MANOVA is used to explore multivariate group differences. Such methodological rigor ensures both validity and reliability, while also providing empirical insights into variations in digital skills among Malaysian PE teachers.

The conceptual framework integrates these elements into a coherent model. SDT explains why teachers are intrinsically motivated to adopt digital skills, while TCT explains how users sustain their use of technology over time. Based on this theory, digital skills are operationalized into six measurable constructs. These constructs are then tested and validated using robust statistical procedures. Demographic factors are embedded to capture variations across teacher groups, ensuring contextual relevance to the Malaysian education system. This systematic flow from theory to practice illustrates not only the study's academic rigor but also its practical implications for policy and teacher development. Ultimately, the framework demonstrates how motivation, continuance, competence, and context interact to shape digital skills among PE teachers. It highlights the importance of grounding digital competence research in both global theory and local realities. By aligning international frameworks such as SDT, TCT, and Digital Competence Framework for Citizens (DIGCOMP) 2.0, Digital Competence Framework (DIGCOMP) 2.1, European Digital Competence Framework for Education, Common Framework for Teaching Digital Competence (INTEF) 2017, The Digital Strategy For Schools (UNESCO) with Malaysia's Education Blueprint and teacher development policies, the study ensures that its findings are actionable and policy relevant. The validated instrument developed through this framework will provide a reliable measure of PE teachers' digital skills, offering insights that can inform professional training, curriculum development, and resource allocation. In this way, the conceptual framework contributes to the scholarly literature while simultaneously addressing the practical challenges of digital transformation in Malaysian education.

3.3 Instrument Development and Adaptation Process

The new instrument was constructed according to the scales suggested by DeVellis (2016), Di Iorio (2005) and McCoach et al. (2013). There are eight steps to the model - identifying the need to measure, expressing the theoretical definition, establishing what the dimensions of the concept are, creating items for each content area by concept-dimension matrix cell, creating scoring and administration criteria for the scale, expert review, pre-pilot testing, and final pilot testing.

This study also adapted items from previous instruments to probe the sample, specifically the PE teachers. These objects were modified to meet the demands and specifications of a new setting, based on population, region, language, cognitive ability,

or any combination of these variables (Sousa et al., 2017). Thus, adapting an instrument involves modifying or customising it to suit specific needs or circumstances. It involves altering, adding to, or changing an instrument's design, functionality, or use to better align with the user's requirements or preferences (Tugsal, 2020). Instrument adaptation requires substantial effort, resources, and expertise, as it involves modifying an existing system to fit new purposes or contexts. When adapting an instrument, the researcher should include the same information in the instruments section as when the instrument was adapted, what changes were made, and why (Verra et al., 2006). Based on the justifications above, the researcher adapted some items for use in the instrument. All questionnaires will be adapted to assess the digital skills of PE teachers in Selangor.

3.3.1 Clearly Determining What To Measure

This study aims to develop an instrument with high validity and reliability to assess the level of digital skills among PE teachers in Selangor. Several constructs have been identified to measure the level of digital skills among teachers, such as the Digital Competence Framework for Citizens (DIGCOMP) 2.0, the Digital Competence Framework (DIGCOMP) 2.1, the European Digital Competence Framework for Education, Common Framework for Teaching Digital Competence (INTEF) 2017, and the Digital Strategy for Schools (UNESCO).

Kilue & Muhamad, (2017) described the main aim of physical education as to promote healthy lifestyle by engaging students in physical, athletic, recreational, and social activities during PE lessons. PE teachers play a role in promoting physical activity and healthy living. They are responsible in encouraging students to participate in different types of sports and recreational activities. It is hoped that this will help them cultivate a lifelong appreciation for fitness. PE lessons are often viewed as the link between academic learning and physical activity as they foster not only fitness but also life skills that are applicable inside and outside of the classroom.

A PE teacher is responsible for teaching a generation about the importance of physical wellbeing, exercise, and general health. PE lesson plans cater to students' varying physical abilities and motivation in the classroom. Lessons may involve solo activities like running or yoga or team-oriented sports like basketball and soccer. However, regardless of the lesson, PE teachers guide students through mechanics and gradually get them used to a regularly active and healthy lifestyle. PE aids in various

motor skills, coordination, teamwork, and other skills needed to foster personal and collective achievement.

PE teaches the fundamentals of sports - an invaluable skill as the modern world becomes increasingly sedentary, with far too many children spending all day indoors behind a screen instead of outside. In this manner, A PE Teacher is more than an educator, he's a mentor, his students' motivational source and cheerleader. He promotes a positive image of physical activity through enjoyable and entertaining and captivating acts of play. He creates a safe space for children to take risks, feel vulnerable when they fail, and continue to strive for self-betterment.

PE teachers are also responsible for school spirit and community connections. PE teachers, in the confines of school, are responsible for such things as sporting events, community efforts. They are the ones who coach sports teams for after-school activities or run community engagement efforts involving fitness and wellness. Such efforts at the school level (by PE teachers) bring students together to work as one and form loyalty and school spirit. PE teachers are also role models. They tend to be the role models for physical health because they are often passionate towards sports and fitness.

There are elements in the physical education curriculum that a PE teacher would have to recognize as better for adapted lessons with special needs populations. For instance, much of the curriculum focuses on team events which can be frustrating for some students who are either less physically or emotionally prepared, but at the same time, certain students who are just inept. Therefore, a PE teacher must recognize when to teach even if the full intentionality is achieved and be willing to modify lesson plans and one's own disposition for a more inclusive, empowering experience. Transition characteristics include teacher tolerance, empathy and flexibility because as a PE teacher, one would want to mix up the games and various levels of assistance to make it enjoyable for all.

Another disposition relative to the PE teacher is a willingness to learn and grow. They're always going to need to learn and grow because of new developments in PE. New sports, wellness offerings, new approaches to teaching, and more become increasingly standardized. PE teachers do not have to meet this area for theoretical application but instead, more practical application approaches. Teachers can learn different approaches to PE through relevant workshops and lectures relative to health and wellness (Normore & Loughry, 2006). Therefore, courses and seminars during PD

can keep a teacher in-the-know with workshops or seminars on new coaching methods or new focuses like sports psychology or injury recovery.

Finally, PE teachers are dedicated and flexible in their approach to overcoming challenges. When they expand their comfort zone with trust, they become the mentoring component of the school for students seeking role model wellness, communication, and life skills. PE teachers are passionate about self-discovery as they challenge students physically and mentally daily and learn how to come together to successfully reach a common goal. Therefore, relying on the PE teacher to keep them motivated to stay in shape encourages many students to stay active throughout their lives.

In addition to these distinctive qualities, PE teachers need technological skills that are unlike other teachers in their lesson planning to support student psychomotor development, cognitive skills, affective skills and physical fitness.

The measurement of PE teachers' digital skills is vital in the current era of educational digitalisation, as technology integration has become a core component of effective teaching and learning. Although digital skills of science, mathematics, and language teachers have been extensively studied, PE instruction is unique due to its dual focus on psychomotor, cognitive, and affective, requiring educators to effectively combine movement-based pedagogy with digital tools such as fitness applications, motion analysis systems, and gamified learning platforms like Quizizz and Wordwall. Meanwhile, the use of digital tools is increasingly widespread and engaging for students, who are regularly exposed to such technologies in today's digital era. Therefore, PE teachers must enhance their digital skills and be equipped with the latest technological tools to support effective teaching and learning.

Assessing PE teachers' digital skills is therefore essential to evaluate their readiness to implement innovative, technology-enhanced approaches that foster student engagement, facilitate performance assessment, and support differentiated instruction in both classroom and field environments (Casey, Goodyear, & Armour, 2017).

In the Malaysian context, this need is further reinforced by national education and digitalisation policies such as the Malaysia Digital Education Policy (2021–2030) and Jalinan Digital Negara (JENDELA), which emphasise equitable digital readiness among educators across all subjects. Despite these initiatives, there are still disparities in digital skills and access to infrastructure. Thus, measuring PE teachers' digital skills provides empirical evidence to identify competency gaps, inform professional development priorities, and ensure that physical education is not marginalised within

the broader digital transformation agenda (Ghavifekr & Rosdy, 2015; European Commission, 2017). Evaluating these competencies also contributes to policy changes by helping determine the critical intersection among digital access, pedagogical innovation, and inclusive education. Thus, this study responds to an urgent national and global educational need to establish an evidence-based understanding of PE teachers' digital skills as a foundation for sustainable, technology-driven pedagogical practice.

The concept of digital skills in education includes the ability to use computers, mobile devices, hardware, the Internet, software, and a variety of digital tools to teach schoolchildren (Abrosimova et al., 2019; Abrosimova, 2020). Furthermore, Md Yusof et al. (2023) and Sari (2024) referred to human abilities such as reading, writing, technical skills, critical thinking, and the ability to find, evaluate, use, share, and generate content using information technology. Thus, the digital competence of PE teachers entails an understanding of technological opportunities and programs with which to enhance the teaching and learning process and the ethical considerations within the context of physical education and the teaching and learning domains of affective, cognitive and psychomotor. Thus, a validated instrument was developed by researchers to evaluate certain digital competence skills of PE teachers based on given digital competence skills to evaluate certain potential improvements in such skills.

3.3.2 Stating the theoretical definition

The two dominant theories underpinning this research study are the Self-Determination Theory (SDT) and the Technology Continuance Theory (TCT). The Self-Determination Theory (SDT) was created by Edward Deci and Richard Ryan and it is a psychological theory of human motivation and what is needed for human development. It aims to find the balance between intrinsic and extrinsic motivations on behaviors and ultimately asserts that people are more motivated under optimal performance conditions when they have relatedness, autonomy and competence. Competence means the capacity to act, being good at something and successfully acting through challenges. One possesses autonomy when they feel they are in control of their actions to make choices consistent with their values and interests. Finally, relatedness is a socially recognized need for interaction with others to feel like one belongs.

SDT posits that when all three psychological needs are consistently met, people are more likely to operate on intrinsic motivation, wanting to do something for the sake

of doing it. Conversely, this theory posits that when the needs of a person are thwarted, they operate more on the motivation of doing something because they have to in order to earn a reward or avoid punishment - for extrinsic motivation. Such controlled motivation or minimally regulated types of motivation do not benefit persons in the long run or for long-term operation. Between the extremes of doing it for punishment or reward vs. doing it because it's an avenue in line with personal values is a motivation that extends to a degree on a continuum. SDT spans various locations and settings - from the classroom to the workplace, athletics and medicine - and findings maintain that when experts promote a nourishing orientation toward autonomy, competence and relatedness, motivation, growth and well-being are facilitated.

Another applicable theory to this research is Technology Continuance Theory (TCT). TCT looks at whether a user continues (or does not continue) to use something in the post adoption world. Technology continuance has a positive association with confirmation expectations, satisfaction, perceived usefulness and perceived ease of use. Essentially, continuance from the Technology Continuance Theory is related to satisfaction and anticipated satisfaction down the line, after use. Discontinuance is for those who are not satisfied or think something has outgrown its usefulness. Yet this expectation perspective relies on Expectancy Disconfirmation Theory whereby some expectations for the technology need to be assumed in advance of use. For example, continuance is positive disconfirmation when user expected expectations. It relates to perceived actual use and expected useful continuance due to expectation has no disconfirmation. However, continuance is negative disconfirmation as well as users have perceived actual use less than expected - and this relates to abandonment/less use. In addition, the theory discusses a post-experience level as well. Therefore, as technology users, people assumption of certain aspects about the systems determine how using technology makes them feel.

Another key aspect of TCT is that it acknowledges that users' perceptions and attitudes will change over time; changing needs, technological advancements, or external factors like peer recommendations can contribute to this decline in use. An earlier version of the Health Experience Journey was published in the Journal of Medical Internet Research (JMIR) as a conceptual delineation of human skills relevant to health technologies, based on the premise that this task is successful.

It is also essential to consider what digital skills mean in the context of PE. As Gutiérrez-Martín & Tyner (2012) mentioned that digital skills are knowledge of the

means or methods for accomplishing a task or "the ability to apply one's knowledge effectively and readily to a task." From this point of view, teachers' digital skills are essential to make pedagogy effective and also to engage with technology. Digital competencies as "ways of being" provide everything required to survive and succeed in this rapid and unpredictable digital environment (Hobbs & Tuzel, 2017). Therefore, with a workforce need for digitally literate and competent individuals in today's society, the integration of digital competencies for PE for transcendental learning experiences is essential for generations to come, as the world will keep turning and technology's role within society will shift. Digital competencies required of PE educators are a wide array of skills that empower the educator to digitize what they want to teach for increased application and student engagement using technology as an assimilated part of learning for the best education and understanding. Digital competencies required for educators in PE can also ease assessments that may otherwise not be possible as a form of assessment in the typical classroom setting

Digital competence is necessary for a PE teacher because they use countless software/applications in lesson preparation and assessment while communicating with parents, other students, and other teachers daily. For example, applications like Google Classroom, LMS, or even specific PE applications for online classrooms create a scenario in which a teacher can meet with students online and then either in person or online digitally, when needed. Therefore, digital aspects allow for student access and learning from home while still getting in-school resources/support should the teacher also be present. Thus, this is critical in an era where blended learning and hybrid teaching are becoming more common; reduced face time is inevitable, teaching digital competency as bring teachers the same playing field.

Beyond lesson planning and communication, these same digital skills transfer to assessment and data collection/review. These digital learning opportunities equip PE educators with the opportunity to assess an increasingly individualistic approach to student physical development and increasingly accurate feedback through data collection/review. For example, wearable technology - fitbit devices, heart rate monitors, even applications like Apple Health that assess movement frequency and effectiveness - allow PE teachers real-time assessment access for student physical development both inside and outside the classroom. This technology enables lessons to be adapted in real-time for appropriate accommodations throughout the lesson. In addition, digital assessments - quizzes on various PE information or required video

submission for a basketball free throw - facilitate assessment of outcomes in an increasingly diverse and complex manner.

Digital learning technology provides physical education teachers with the possibility for an enhanced PE experience through multimedia, simulations and virtual classroom experiences. For example, teachers can utilize technology to present videos or animations for complicated movements, biomechanics or game approaches that help students visualize an otherwise challenging concept. It's not much of a stretch for educators to engage VR or AR technology to simulate realistic sporting events to give students access to opportunities they would never have (or might otherwise not get in a standard classroom). Such resources supplement the curriculum and provide varied, attractive methods for the kinesthetic and visual auditory learners,

Digital literacy skills champion the idea of lifelong physical activity and digital literacy within the physical education curriculum because digital literacy skills equip the physical educator to teach students how to use technology to assist them in fitness and wellness endeavors beyond the scheduled school day. There are countless apps that students can use for workouts, meal prep, and mental health endeavors to promote a better quality of life, for example. This type of growth in digital literacy empowers students to take responsibility for their wellness both in and out of the physical education classroom by giving them knowledge and skills necessary for educated decision-making that they can carry with them into life.

Digital literacy skills are certainly required by modern PE teachers, for this enables the educator to make the material more applicable, engage students better, and subsequently, improve health and wellness. The more technology is embraced, the more PE teachers can make the most out of their teaching pedagogy and teach their students to embrace such digital literacies - digital literacies that will only continue to dominate society in every field, even health and wellness. Therefore, it must be understood that increasingly, digital literacy is an omnipresent aspect of the curriculum that PE teachers have to constantly relearn and relearn for their own technological competencies to learn how to learn in an increasingly digital world. The next step is to define key elements and theories of digital literacy for the PE teacher.

3.3.3 Identify Dimensions of the Concept

Various constructs capture the expansive concept of digital competencies in everything educational, which means these constructs are critical for literacy, collaboration, creativity, cybersecurity, problem-solving, pedagogy and use for better learning and teaching practices with an emphasis on professional development. Therefore, there are six constructs in this study:

3.3.3.1 Information and Data Literacy

Information and data literacy involve the ability to assess, find, and use information across digital platforms. Information and data literacy champion that the user possesses the proper competence to explore and assess information for educated decisions and findings in a classroom environment. Therefore, information and data literacy are implemented as a digital-age necessity since each PE educator and student must assess considerable amounts of data to make better-informed decisions. How do PE educators assess information and data literacy through digital means such as journals, sports research databases, and other online resources for exercise science in an ethical way? (Varea et al., 2022). For instance, PE educators may use data from fitness technology (Fitbit or Apple watch) to assess PE student's participation levels as the semester progresses. They may note physical education goals over time or contrast average minutes exercised over time as a group. Over time, the data collected suggest individualized goals when trends lean one way while PE educators can utilize such information to support their lesson plan and intervention suggestions. In addition, PE educators can help students research sports-related question online, and assess the reputable, reliable and suitable online resources available (Casey et al., 2016).

3.3.3.2 Communication and Collaboration

Communication and collaboration refer to the sharing of information and ideas with others and the ability to work together, facilitated by digital spaces and environments supporting digital collaboration, teamwork, collaborative learning interpersonal skills, and professional communication. Communication and collaboration are integral PE skills for students to collaborate with one another or PE

teachers to collaborate among themselves and with parents. Students can send various pieces of information through digital platforms, google classroom, Microsoft teams, Edmodo, requesting input on schedules for class, fitness challenges, and homework assignments required. For example, one potential activity is a group assignment where students utilize a sports performance data source to survey data about one sport and present their findings virtually, utilizing presentation tools. Instructors can collaborate with PE instructors across the globe via Zoom and other video conferencing platforms for a more comprehensive approach to resource acquisition and instructional possibilities. Students can collaborate on Padlet or Trello as these provide opportunities for students to be involved in team-based projects, monitor team progress, and support teamwork and group solutions.

3.3.3.3 Creation of Digital Content

Digital content creation is the process where teachers create this multimedia content through the software and technologies educators need. For a PE teacher, this might be dynamic video resources or interactive graphics that make the material more engaging for learners. In PE, digital content is videos or PowerPoint slides that stimulate learners and convey ideas/information effectively as each concept may be new to the learner. For instance, an educator might create a video for their students to illustrate the different stretches, sports techniques, applications of warm-ups that they can emulate or do correctly. A PE teacher might upload these videos to YouTube or Vimeo so that students may replay the lessons and revisit the footage as often as necessary (Fernández-Gavira et al., 2021; Xie et al., 2017). Similarly, they can use Canva or Prezi to explore digitally facilitated lessons as multimedia, interactive content that breaks down more complicated subjects like sports biomechanics or the physiological benefits of certain exercises. This content can also assess students; for instance, they might submit a video of themselves practicing a sport or a digital fitness portfolio.

3.3.3.4 Security

Security is knowing how to protect against access and breaches, confidentiality and proper information access. It is a necessary component of digital literacy in the

classroom, as many digital tools are created from a need to collect personal student information that must be subsequently handled correctly.

For PE, this involves understanding how to protect personal/private information and health information in the digital world (Muniandy et al., 2022). For example, a PE teacher uses an online application to measure her students' fitness levels. The connection to data security is the teacher's ability to ensure that the application or system is in compliance with GDPR and FERPA and the ability to teach students how to maintain their own digital privacy when exercising or competing online. For example, the teacher could teach the students how to make their profiles private on the fitness apps or physical education apps issued by the school or show them how to create secure passwords to lock hackers out of their physical education-based platforms.

Using digital skills ethically and responsibly also applies to physical education as both students and teachers exhibit proper digital citizenship (Kirschner & Davis, 2003). Therefore, PE teachers must show their students how to use technology for virtual sporting activities, fitness challenges or when teaching in an off-site, virtual environment. For instance, should teachers encourage their students to partake in an online game of soccer or a 30-day plank challenge, rules should be established from the very beginning of respecting the privacy and ideas of others. Should social media be encouraged to promote the days' exercises or student's progress, the context should be clear that such information is shared with everyone but should not be taken personally when it comes to digital citizenship. Thus, respect should be shown to others when it comes to digital citizenship yet teachers can help students realize how what they do affects themselves and everyone else - from exercise apps to health data.

3.3.3.5 Problem Solving

Improving digital and problem-solving skills involves strengthening the school community's digital skills by enabling its members to take ownership of digital resources. In other words, these skills allow them to use technology to find and develop solutions through analyzing, making decisions, and resolving complex problems. Technological problem solving is frequently offered in response to means of assessing problems, assessing problems, and solutions as they relate to PE and sports. For instance, there are exercise apps and digitally projected motion capture projects through which a teacher assesses performance and needs (Goad & Jones, 2017). For example, a

PE teacher may use a digital motion capture application, called Dartfish, to assess a student's dive or cartwheel. When the Dartfish application captures the motion and illustrates a below average height of jump or rotation, the PE teacher checks that box on the report and uses that assessment to improve this skill for the optimum performance in the class. Therefore, students have access to technology for problem solving as well in a self-best challenge. For example, a student may realize that their weakness is flexibility; therefore, they can use an app that tracks their flexibility week by week and assesses different stretches, experimenting with which stretch may yield the highest score from the assessments of different weeks. Moreover, problem solving extends beyond the field and into the classroom where technology as a scheduling app or zoom sessions to schedule different dynamic elements that constitute an effective PE classroom - especially in a hybrid setting - are valuable.

3.3.3.6 Teaching, Learning, and Assessment

Digital skills for communication, collaboration, and digital citizenship foster extended teacher opportunities for learning and student engagement. For example, digital skills foster orientation and scaffolding based on interest or learning readiness and enhanced digital, social and professional skills through webs and educational applications. Digital skills for teaching, learning and assessment allow PE teachers to better support the educational process, uniquely tailored learning opportunities, and digital assessments that gauge student understanding and growth. Online quizzes and interactive assessments (Quizizz or Kahoot!) can measure information retention about sports rules, exercise biomechanics and sports nutrition. Similarly, digital assessments can help PE teachers engage student gain in measurement feedback. For example, teachers can video students' swings/throws/runs or gather data from motion sensing devices to assess student results for specific teaching in measurement feedback. Furthermore, Digital assessment opportunities provide a more inclusive educational environment as students will receive differentiated resources from their teachers. For example, an online workout module might offer different levels of intensity for students with varying appropriateness of personal fitness levels.

Therefore, the six dimensions of digital skills support a more interactive, connected and creative pedagogical approach in physical education where both teachers and students can engage as best suited for thriving in a digital world. Where the six

dimensions of digital skills are seamlessly integrated PE teachers can enhance their effectiveness both as educators and professionals while benefiting from practical applications of 21st century learning for responsible, collaborative and creative purposes.

3.3.4 Write items for each content domain by concept-dimension cell in the matrix

The matrix helps the researcher establish the content sections and the quantity of items to write, but the researcher must rely on other sources for item phrasing. These include experts (via literature review or personal contact), qualitative interviews with population representatives, and various measurement equipment.

From the literature, the researcher identified six constructs of digital skills related to PE teachers. These domains include information and data literacy, communication and collaboration, creation of digital content, security, problem-solving, teaching, learning, and assessment. The researcher identified a total of 43 items and grouped them into six constructs: teaching, learning, and assessment (Q1-Q8), information and data literacy (Q9-Q15), creation of digital content (Q16-Q23), communication and collaboration (Q24-Q31), problem-solving (Q32-Q36), and security (Q37-Q43). These items were then included in the questionnaire distributed to the respondents.

Table 3.1
Six Constructs of Digital Skills Related to PE Teachers

Construct	Items
Teaching, Learning, and Assessment	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8
Information and Data Literacy	Q9, Q10, Q11, Q12, Q13, Q14, Q15
Creation of Digital Content	Q16, Q17, Q18, Q19, Q20, Q21, Q22, Q23
Communication and Collaboration	Q24, Q25, Q26, Q27, Q28, Q29, Q30, Q31
Problem-Solving	Q32, Q33, Q34, Q35, Q36
Security	Q37, Q38, Q39, Q40, Q41, Q42, Q43

3.3.4.1 Items Alignment with Research Objectives.

Questionnaire items must be clearly linked to the specific aims of the investigation, aligning directly with the research objectives and goals, and using straightforward terminology easily comprehended by those completing the survey. Questions should precisely mirror the study's core targets, especially in gauging digital skills proficiency among PE teachers and instructors. For instance, when exploring how PE teachers integrate digital tools into their lessons, survey questions may focus on technologies used in PE settings, such as fitness monitoring apps, instructional videos, or virtual learning environments. Questions like "To what extent do you leverage digital tools such as fitness apps or videos to demonstrate exercises in your PE classes?" specifically address the goal of examining technology integration in PE instruction. Likewise, items related to the communicative aspect of digital skills, like "Do you utilize online platforms to share lesson plans, assignments, or feedback with your PE students?" assess the role of digital communication in facilitating teacher-student engagement in PE contexts.

Moreover, items should assess how effectively PE teachers use digital tools to evaluate student achievement. A question such as "With what frequency do you harness digital evaluation instruments (e.g., online quizzes, motion analysis software) to gauge students' physical abilities or fitness development?" directly aligns with the research objective of determining how digital skills are used for formative and summative assessment in PE classes. Questions regarding the ethical and secure use of digital tools are also significant, such as "Are you familiar with the ethical guidelines and privacy regulations for leveraging digital tools with students in your PE classes?" These questions help ensure the study captures PE teachers' technical abilities and their understanding of the importance of privacy, security, and responsible digital practices in the educational environment.

Notably, crafting items that precisely mirror the study's aims and are comprehensible to PE teachers would help the researcher gather invaluable data on how digital skills impact teaching, learning, and assessment in Physical Education. In this regard, questions must be relevant, straightforward to answer, and specific to the PE context, ensuring they accurately reflect the use and importance of digital tools in enhancing the educational experience in PE.

3.3.4.2 Complete Sentences

Each item should be composed comprehensively with an applicable topic and verb. The use of complete sentences is preferred over single words or brief expressions when assembling survey items, as this strategy ensures clarity and prevents ambiguity among respondents. For instance, rather than inquiring, "Do you utilize digital devices?" a more suitable item for a PE teacher could be "What number of occasions every week do you utilize digital devices, for example, wellness tracking applications or educational recordings, to upgrade your PE lessons?" It provides a clear sentence that incorporates a topic ("you") and a verb ("utilize"), making it easy for the PE teachers to understand and provide precise feedback.

Additionally, rather than asking, "Do you collaborate with other teachers utilizing digital devices?" the item can be phrased as, "What number of occasions have you cooperated with other PE teachers over the past 6 months through digital platforms, like Google Classroom or Microsoft Teams, to teach Physical Education?" This item is written comprehensively, with a subject ("you"), a verb ("team up"), and a clear setting (sharing resources). By ensuring that each item adheres to this structure, it becomes increasingly available and applicable to PE teachers, allowing them to provide more precise responses tailored to the exploratory goals. This strategy likewise ensures that each item effectively captures the specific digital skills and investigates the skills possessed by PE teachers.

3.3.4.3 All items should be brief and straightforward when requesting data information on neutral topics

Keeping survey items straightforward and concise when exploring neutral topics makes questions easier to comprehend and reduces the risk of measurement errors during data collection. For example, when asking about the frequency of digital device use in PE, a clear and concise item should be used, such as "To what extent do you utilize health programs or electronic resources in your PE classes?" This question is unambiguous, simple to understand, and immediately relates to the investigation goal without unnecessary complexity.

At the same time, items that could be used to evaluate digital device usage, such as "Do you employ online platforms to communicate with students in your PE classes?"

are simple and to the point. It avoids convoluted wording while still capturing relevant information. By keeping the items brief, the survey ensures that respondents, particularly PE teachers, can answer them accordingly. The use of precise items ensures that the information gathered reflects the genuine thoughts of PE teachers, making it easier to analyze and derive insights into their digital abilities.

3.3.4.4 Using Open-Ended Questions for Sensitive Issues

Open-ended or detailed questions are posed when seeking information on delicate issues. Regarding sensitive subjects, open-ended questions allow respondents to express their thoughts more deeply. It is pivotal to approach questions about sensitive topics delicately, as individuals may be inclined to conceal socially undesirable activities. In the context of PE teachers, sensitive points include ethical use of information, security practices when using digital devices, and individual challenges in adapting to new technologies. For instance, rather than soliciting straightforward yes/no questions, for example, "Do you consistently ensure student information protection when utilizing digital instruments in PE?" the item can be phrased as, "Would you be able to portray any difficulties in ensuring the privacy and confidentiality of information when utilizing digital devices in your PE classes?" This open-ended question allows PE teachers to share any difficulties or worries they may have, providing richer, more in-depth information about their concerns.

Comparably, when investigating the degree of digital device acceptance in PE, an open-ended question, for example, "What elements impact your choice to incorporate or not incorporate digital devices into your PE instructional practices?" permits respondents to reflect on individual or powerful hindrances, for example, a deficiency of preparation, assets, or time. By using open-ended questions for sensitive issues, scientists can gather more honest and thorough insights while limiting the risk of socially desirable responses. This methodology likewise urges PE teachers to provide explicit settings or experiences that may not be gained through simpler, closed-ended items.

3.3.4.5 Considering Comprehensive and Exclusive Choices of Response

Comprehensive and nuanced considerations must be taken when developing questionnaires. In designing surveys, researchers need to ensure that answer options are both exhaustive and independent. They should provide selections that are mutually distinct yet span a broad range, allowing respondents to offer transparent, unambiguous replies. For example, in probing the frequency of utilizing digital methods in physical education classes, rather than merely suggesting “Often” and “Rarely,” a more effective approach is to deploy a graded scale with distinctive and all-inclusive choices like "Never," "Seldom," "Occasionally," "Frequently," and "Always." This guarantees that each response is unique and that respondents can accurately mirror their usage patterns free of ambiguity.

Additionally, when asking about the digital tools used in physical education, the response options should cover a wide range of devices commonly used in the field, for instance, "Fitness applications," "Video analytic tools," "Online resources for preparation," and "Digital evaluations." Including "Other (explain)" as an alternative allows for answers that may not fit the predefined groups while still ensuring that the choices remain independent. Tendering transparent, exhaustive, and separate response selections ensures that physical education teachers can select the most accurate response, enriching the credibility of the collected data and providing a more detailed understanding of how digital tools are used in physical education instruction.

3.3.4.6 Clearly Defined Acronyms

The researcher should define each acronym used in the abbreviation section before it appears in the questionnaire. This ensures that respondents and PE teachers fully understand the terminology being used, particularly when the acronyms are specific to educational or technological contexts. For example, acronyms such as "ICT" (Information and Communication Technology) or "PE" (Physical Education) should be defined in the abbreviation section as "Information and Communication Technology (ICT)" and "PE (PE)" before they are used throughout the questionnaire.

Clearly defining acronyms at the beginning of the questionnaire increases its accessibility and comprehensibility. This ensures that all respondents interpret the questions the same way. Hence, it is imperative when discussing specific digital tools

or educational frameworks that may be unfamiliar to some PE teachers. For instance, questions such as "Do you use any ICT tools for planning and delivering your PE lessons?" will be clearer to respondents if the acronym "ICT" is defined earlier. This approach minimizes confusion, enhances comprehension, and ensures that the responses reflect the intended meaning of each item.

3.3.4.7 Clarify any unusual terms

The researcher ought to clarify any unusual phrases or terms in the survey to ensure respondents understand the questions adequately and answer them accurately. This is particularly significant in the ambit of PE (PE), where specialized terminology linked to electronic tools or academic procedures might not be universally familiar to all PE trainers. For example, terms such as "gamification," "flipped classroom," or "learning management systems" may necessitate more explanation. In this respect, the questionnaire could involve succinct definitions or illustrations for terms like "Gamification", which refers to the usage of game structure factors in non-game circumstances, such as incorporating competitive aspects or rewards into PE classes utilizing digital tools."

Presenting descriptions for unfamiliar terms helps ensure that all respondents interpret the questions identically, regardless of their level of experience or familiarity with specific ideas. For example, an item such as "How frequently do you employ blended learning in your PE classes?" should be accompanied by a definition of blended learning, such as "Blended learning refers to an instructing method that combines conventional in-person instruction with online learning activities." This additional clarification ensures that PE teachers can respond accurately based on their understanding of the term, resulting in more reliable and valid data.

By using specialized terms, the researcher can reduce confusion and improve response quality, making the survey more effective at capturing the digital skills competencies of PE teachers.

3.3.4.8 Only items that contain one idea should be written in a questionnaire

Both complexity and variety in sentence structure are important considerations when designing an effective questionnaire. Asking about two separate concepts together

can introduce ambiguity, hindering respondents' ability to choose the most suitable answer. For clarity, it is preferable to separate related ideas into distinct questions.

For instance, rather than inquiring, "How often do you use digital tools for teaching and assessing student performance in PE?" - which joins teaching and assessment - these notions are better addressed independently as "How often do you use digital tools for teaching in PE?" and "How often do you use digital tools for assessing student performance in PE?".

By focusing each item on a single theme, the survey allows PE teachers to respond accurately based on their expertise and practices with digital technologies. Analyzing replies is also simpler since each question quantifies a specific facet of digital proficiency in PE, whether for instruction, evaluation, or communication. In this way, formulating inquiries that are simple and centred on a single notion ensures the reliability and validity of the collected data.

3.3.4.9 The written items must be specific

The researcher should guarantee explicitness in the drafted items to circumvent ambiguity. This is due to obscure or overly broad questions that can lead to confusion among the respondents, resulting in a weaker interpretation of the information. For example, when inquiring, "Do you use technology in your actual physical training instructions?" a more explicit item would be, "Which digital instruments do you utilize for coaching physical workouts or athletic strategies in your actual physical instruction classes?" The revised item provides clear direction on what is being interrogated and centres the respondent on the facets of technology employed in actual physical instruction.

Specificity also helps respondents understand what is being quantified, ensuring they can provide more accurate and relevant responses. When asking about the use of digital tools, rather than general terms like "technology," it is essential to specify whether the question refers to programs, fitness trackers, video examination instruments, or other digital tools. For example, "How frequently do you utilize fitness monitoring programs (e.g., Strava, MyFitnessPal) to screen student performance in actual physical instruction?" This precise terminology allows PE teachers to respond based on their genuine practices, ensuring the responses mirror their use of specific digital devices in teaching. By using explicit items, the questionnaire improves the

reliability of the collected data, enhancing the overall quality and credibility of the analysis.

3.3.4.10 Use simple words when writing items

While researchers should communicate effectively with participants from diverse backgrounds, some variability in sentence structure and terminology offers benefits. Straightforward phrasing improves comprehension, yet moderate complexity engages more fully. Simpler terms help ensure comprehension regardless of experience, allowing accurate self-reporting. In this regard, jargon such as "digital pedagogical strategies" should be avoided; instead, the items ask whether videos or online resources aid exercise instruction.

Removing potential barriers through clarity is crucial while reducing anticipated risks of oversimplification. Varied questioning maintains interest. Technical language challenges some, yet stimulates others. Judiciously balancing simplicity and richness yields the most representative responses. Clarity facilitates participation and relevance regardless of digital exposure. However, uniform blandness may under-engage specific demographics. Overall, targeted diversity within a shared understanding maximizes inclusive data quality and insight.

3.3.4.11 Terms that could easily be missed should be highlighted

The researcher should highlight terms that are easily overlooked using methods like capitalization, boldface, italics, underlining, or color changes. This helps draw attention to specific words or phrases in the questionnaire, ensuring that the respondents do not overlook essential concepts. For example, when asking about the use of specific digital tools, terms like "fitness tracking apps" or "online assessment platforms" can be **bolded** or *italicized* to emphasize their importance and ensure that respondents understand the exact tools being referenced.

In a question like, "How often do you use **fitness tracking apps** such as Strava or MyFitnessPal to monitor student progress in PE?" highlighting "fitness tracking apps" helps respondents focus on the specific digital tools being asked about, reducing the risk of confusion or misinterpretation. Similarly, when discussing ethical practices in using technology, terms such as "privacy," "data protection," and

"confidentiality" could be underlined or highlighted to ensure that PE teachers understand the importance of these aspects when using digital tools. By highlighting key terms, the questionnaire becomes clearer, guiding respondents to focus on the most critical parts of each question and improving the accuracy of their responses.

3.3.4.12 Providing a specific timeline to ensure consistency for items that require recall

Providing a specific timeframe helps guide respondents when answering questions that require recalling past actions or behaviors, thereby ensuring more consistent and accurate responses. For example, instead of asking, "How often do you use digital tools in your PE lessons?" a clearer item would be, "In the past month, how often have you used digital tools in your PE lessons?". This establishes a specific time frame and helps respondents focus on their recent practices, making their answers more relevant to the research.

Specifying a time frame, such as "over the last semester" or "within the past year," helps PE teachers to easily recall their experiences with digital tools, instructional strategies, or assessment methods. It also reduces the likelihood of respondents providing vague or inaccurate answers, as they have a concrete period to reflect on their usage patterns. This approach enhances data reliability by ensuring that all respondents answer within the same context and timeframe, making it easier to compare and analyze responses.

3.3.4.13 Using Range Instead of Precise Values for Sensitive Items

For sensitive items, ranges are used rather than precise values. Ranges offer a method similar to open-ended questions, which is especially useful when gathering sensitive information such as monthly income or personal behaviors. In the context of PE teachers, this approach can be applied to questions about technology usage, professional development, or teaching hours. For example, instead of asking, "How many hours per week do you spend using digital tools in your PE lessons?" a more sensitive and acceptable option would be, "How many hours per week do you typically use digital tools in your PE lessons? (Please select one: 0-2 hours, 3-5 hours, 6-8 hours, more than 8 hours)."

By offering ranges, respondents can feel more comfortable providing answers that reflect their actual behaviors without the pressure of giving a precise number, which may seem too invasive or difficult to estimate accurately. This method increases the likelihood of honest responses, especially for sensitive topics such as self-assessment of teaching skills or the frequency of technology integration in PE, while still providing sufficient granularity to analyze trends and patterns in the data.

3.3.4.14 Carefully deciding options for responses

Careful decisions about which response options to include are essential when designing a questionnaire. Thoughtful consideration is necessary to ensure respondents have a comprehensive list of alternatives to choose from, thereby avoiding the need for additional prompting. For instance, when assessing a PE teacher's confidence in using digital tools for lesson planning, a 5-point Likert scale would be appropriate: 1 for strongly disagree, 2 for disagree, 3 for neutral, 4 for agree, and 5 for strongly agree. This scale is widely used and effective for capturing the range of respondents' opinions and behaviors, enabling more nuanced responses that reflect their experiences and perceptions.

Although there is no consensus on the exact number of points for a Likert Scale, the decision to use a five-point scale aligns with previous research that suggests its benefits in increasing response rates, improving data quality, and reducing respondent frustration (Beglar & Nemoto, 2014). In the context of PE teachers, this scale allows them to indicate how strongly they agree or disagree with statements about their use of digital tools, their comfort with technology, and the perceived impact of digital skills on student engagement. By including a clear set of response options, the questionnaire provides a structured format that makes it easier for PE teachers to respond, increasing the reliability of the data and facilitating analysis.

The initial 43 items, which were based on six constructs, are detailed below:

Table 3.2
The Initial Items Based on Six Constructs

Construct	Item	Theory	Instrument
1. Teaching, Learning & Assessment	1. Quizizz/Kahoot/Wordwall/other gamification tools are used in my PE classes. <i>Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz / Kahoot / Wordwall dan lainlain.</i>	TCT	Adaptation
	2. The online quiz's time allocated is sufficient. <i>Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.</i>	SDT	Develop
	3. I find it easy to learn something by reading from digital devices. <i>Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.</i>	TCT	Develop
	4. I use websites to support my teaching in PE subject. <i>Saya menggunakan laman web untuk membantu pengajaran saya dalam subjek Pendidikan Jasmani.</i>	TCT	Develop
	5. I use computers for teaching and facilitation (PdPc) purposes for PE subject. <i>Saya menggunakan komputer untuk tujuan pengajaran dan pemudahcaraan (PdPc) bagi subjek Pendidikan Jasmani.</i>	TCT	Develop
	6. I fairly evaluate each homework that students turn in using the online application. <i>Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian</i>	TCT	Develop
	7. I can create a basic Word Document for my teaching and facilitation (PdPc) purposes. <i>Saya dapat mencipta dokumen Word asas untuk tujuan pengajaran dan pemudahcaraan (PdPc).</i>	SDT	Develop
	8. I can search for information on the PE subject using a web search engine for teaching and facilitation (PdPc). <i>Saya dapat mencari maklumat untuk subjek Pendidikan Jasmani menggunakan enjin carian web bagi tujuan pengajaran dan pemudahcaraan (PdPc).</i>	TCT	Develop
2. Information and Data Literacy	9. I can use media devices to present information to the students. <i>Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid.</i>	TCT	Develop

Construct	Item	Theory	Instrument
	10. I find it easy to find a website I visited before. <i>Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.</i>	TCT	Adaptation
	11. I can use media devices such as laptops, handphones, and computers as teaching aids (BBM/ABM) for PE subjects. <i>Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.</i>	TCT	Adaptation
	12. When I use the internet to research a topic related to physical education, I feel extremely motivated. <i>Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.</i>	TCT	Adaptation
	13. I can use different sources of information such as Google/YouTube/ Yahoo! for the PE subject. <i>Saya boleh menggunakan pelbagai sumber informasi seperti Google/You Tube/Yahoo! untuk subjek Pendidikan Jasmani.</i>	TCT	Develop
	14. I can use media devices to communicate with students. <i>Saya dapat menggunakan pelbagai peranti media untuk berkomunikasi dengan murid</i>	TCT	Adaptation
	15. I can create media content by using PowerPoint/ Microsoft Word /Google Meet for PE subjects. <i>Saya dapat menghasilkan bahan media menggunakan Power Point/ Microsoft Word/Google Meet untuk subjek Pendidikan Jasmani.</i>	TCT	Adaptation
3. Creation of Digital Content	16. Through online media platforms, I share the personal media that I created, such as digital art, with my students. <i>Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian.</i>	SDT	Adaptation
	17. I, collectively with other PE teachers, build digital instructional tools for my students. <i>Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.</i>	SDT	Adaptation
	18. I am familiar with the rules of the user agreements for websites where I produce.	SDT	Adaptation

Construct	Item	Theory	Instrument
	<i>Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.</i>		
	19. I employ image editing applications to adapt audio-visual material to my online teaching and facilitation (PdPc) purposes. <i>Saya menggunakan aplikasi sunting imej untuk menyesuaikan bahan audio-visual dengan keperluan pengajaran dan pemudahcaraan (PdPc) dalam talian saya.</i>	SDT	Adaptation
	20. I learn how to use media platforms for developing digital educational content by watching online tutorials. <i>Saya belajar cara menggunakan platform media untuk memperoleh kandungan pendidikan digital dengan menonton tutorial dalam talian.</i>	TCT	Adaptation
	21. I always keep the source of any data I obtain from any platform on my digital devices. <i>Saya sentiasa menyimpan data yang saya dapat daripada pelbagai platform sebagai dokumen dalam peranti digital saya.</i>	TCT	Adaptation
	22. I can make any changes to information during online teaching for PE subject on my digital devices. <i>Saya boleh membuat sebarang perubahan maklumat semasa pengajaran dalam talian untuk mata pelajaran Pendidikan Jasmani pada peranti digital saya.</i>	SDT	Adaptation
	23. I have experience using resources that will benefit my online teaching. <i>Saya mempunyai pengalaman menggunakan sumber yang dapat membantu saya untuk pengajaran dalam talian.</i>	TCT	Adaptation
4. Communication and Collaboration	24. I am aware of the existence of educational social networks. <i>Saya sedar dengan kewujudan rangkaian sosial pendidikan.</i>	SDT	Adaptation
	25. I know how to use emoticons. <i>Saya tahu cara menggunakan emoji.</i>	TCT	Develop
	26. I use digital technologies to communicate in online environments. <i>Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.</i>	TCT	Adaptation
	27. I can make a decision on which media platform to follow online. <i>Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.</i>	TCT	Adaptation

Construct	Item	Theory	Instrument
	28. I am satisfied with my ability to adapt to the changes in technology. <i>Saya sangat berpuas hati dengan kebolehan saya untuk menyesuaikan diri dengan perubahan teknologi.</i>	TCT	Adaptation
	29. For teaching materials for physical education, I use information from the internet. <i>Sebagai bahan pengajaran pendidikan jasmani, saya menggunakan informasi daripada internet.</i>	TCT	Develop
	30. I know which information I should share online. <i>Saya tahu maklumat mana yang patut saya kongsi dalam talian.</i>	SDT	Adaptation
	31. I know how to remove friends from my platform media lists (e.g., TikTok, Instagram, Facebook). <i>Saya tahu cara mengeluarkan rakan daripada senarai platform media saya (e.g. Tiktok, Instagram, Facebook).</i>	SDT	Adaptation
5. Problem Solving	32. I can identify the causes of technical problems when using digital devices. <i>Saya dapat mengenal pasti punca masalah teknikal apabila menggunakan peranti digital.</i>	SDT	Adaptation
	33. I can solve the technical problems I encounter when using digital devices. <i>Saya dapat menyelesaikan masalah teknikal yang saya hadapi apabila menggunakan peranti digital.</i>	SDT	Adaptation
	34. I can update my anti-virus software on my computer. <i>Saya boleh mengemas kini perisian antivirus saya pada komputer saya.</i>	SDT	Adaptation
	35. I am familiar with a variety of media file formats. <i>Saya biasa dengan pelbagai format fail media.</i>	TCT	Adaptation
	36. I have addressed various technical problems with my digital equipment through online communication. <i>Saya telah menangani pelbagai isu teknikal dengan peranti digital saya melalui komunikasi dalam talian.</i>	TCT	Adaptation
6. Security	37. I develop my digital competence by always following new developments. <i>Saya meningkatkan kompetensi digital saya dengan sentiasa mengikuti perkembangan baru.</i>	SDT	Develop

Construct	Item	Theory	Instrument
	38. I can evaluate the trustworthiness of information found on the internet. <i>Saya dapat menilai kesahihan maklumat yang terdapat di Internet.</i>	SDT	Adaptation
	39. I am aware of how to overcome students who are addicted to digital. <i>Saya tahu bagaimana cara untuk mengatasi murid yang ketagihan digital.</i>	SDT	Adaptation
	40. There is enough cooperation between teachers for ICTs issues. <i>Terdapat kerjasama yang cukup antara guru berkenaan isu teknologi maklumat.</i>	SDT	Develop
	41. I use protection software such as antivirus on all my devices. <i>Saya menggunakan perisian perlindungan seperti antivirus pada semua peranti saya.</i>	TCT	Adaptation
	42. To avoid physical harm, I keep track of how much time I spend online. <i>Saya mengambil tahu mengenai tempoh masa yang saya luangkan dalam talian untuk mengelakkan kemudaratan fizikal.</i>	SDT	Adaptation
	43. I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression. <i>Saya sedar tentang risiko kesihatan yang berkaitan dengan penyalahgunaan teknologi seperti obesiti /gangguan penglihatan/kemurungan.</i>	TCT	Adaptation

The research employed a comprehensive questionnaire comprising 43 items across six constructs: Teaching, Learning, and Assessment; Information and Data Literacy; Creation of Digital Content; Communication and Collaboration; and Problem Solving and Security. In summary, the questionnaire consists of 43 items, with 15 items based on SDT and 28 items based on TCT. The SDT-based items focus on the motivational and psychological aspects of digital competency, emphasizing teachers' intrinsic motivation, autonomy, and satisfaction with technology use. In contrast, the TCT-based items address the practical skills and technical knowledge necessary for the effective use of digital tools in teaching and learning. The distribution of items across the constructs ensures that both the psychological and technical aspects of digital skills are comprehensively assessed.

This distribution reflects the primary focus on practical technological competence in the context of physical education teaching while also acknowledging the importance of motivation and self-regulation in the effective use of digital tools.

3.3.5 Write the rules for the scoring and administration of the scale

This study used the Likert scale as the measurement instrument. Participants are asked to rate their degree of agreement (from strongly disagree to strongly agree) with a set of assertions (items) about a real or hypothetical topic under study, using a Likert scale (Joshi et al., 2015). The Likert scale is commonly used to assess beliefs, opinions, and attitudes in the affective domain (DeVellis, 2016; Kalkbrenner, 2021; McCoach et al., 2013). Previous studies indicated that scales with more than six categories are rarely tenable due to constraints in working memory capacity. Moreover, a four-point scale is preferable for young respondents and those with low motivation to complete the survey, as it is simple to understand and requires less effort (Guerrero-Romera et al., 2021). Hence, the researcher used the Likert Scale for this study, as it is suitable for capturing the affective domain in social studies. The Likert scale is also easy to construct and can yield highly reliable scales (Taherdoost, 2019).

In the meantime, there are several opinions on the number of Likert scales appropriate for the study, ranging from 2 to 11 (Taherdoost, 2019). The most preferred Likert scales are the 5-point and 7-point scales. This is because the more scale is used, the smaller the increase in reliability will be, so minor that it will not be worth the effort to investigate the difference or create the instrument (Joshi et al., 2015). The effect of rating scales with different lengths can be examined based on reliability, validity, response style, respondents' preferences, and respondent friendliness throughout the survey. (Taherdoost, 2019) observed that the reliability increased from the 3-point scales up to the 7-point scales, while the results of reliability were similar for the 7-point and 11-point scales. The respondents concluded that 10-point, 7-point, and 5-point scales are easy and quick to use, and, more specifically, that rating scales that are too small cannot reveal much about the distinctions a person makes among a vast variety of items. A previous study found that the 5-, 7-, and 10-point rating scales are less ambiguous and more responsive (Taherdoost, 2019). Therefore, in this research, a 5-point rating scale was chosen for the instruments that will be developed. The 5-point Likert scale is also easier for respondents and the researcher to understand. It is also less

time-consuming to administer and less effort for the respondent to complete, so it can capture the respondent's true feelings when answering the instrument question. The 5-point rating scale chosen ranges from 1 (strongly disagree) to 5 (strongly agree).

3.3.6 Expert Review

Next, the items developed underwent expert review. Expert reviews of the item pool can help support or disprove the phenomenon under study. Experts' feedback on the relevance of each question helps increase the questionnaire's content validity (Kalkbrenner, 2021). Each panel member's expertise in the subject matter of the instrument is necessary to evaluate the content validity of the items during the judgment stage of the content validity procedure (Feren et al., 2011). Throughout the process, members of the expert panel could ask any questions or seek clarifications on specific phrases or ideas, and provide suggestions for development. According to Shrotryia & Dhanda (2019), a content specialist needs at least 2 or 3 people. However, it is unlikely that more than 10 experts could be included, as the likelihood of consensus decreases with the number of experts. (Yusoff, 2019), the expert panel's suggestion is 5-10 for content validity. Thus, a panel of 6 experts was selected for the pre-pilot study based on recommendations from the experts.

The process involved two bilingual experts, proficient in both English and Malay, who identified and corrected any gaps or inconsistencies in translation. The experts involved were a senior lecturer from the Faculty of Language and Communication at Universiti Pendidikan Sultan Idris (UPSI) and a Guru Cemerlang Bahasa Melayu (Malay Language Excellent Teacher) from Maktab Sultan Ismail, Kota Bharu, Kelantan. The primary goals are to ensure accurate translation and alignment between forward translations. Throughout the process, the expert panel may query specific terms or phrases and propose alternatives. They should be provided with relevant materials to maintain consistency with previous translations. The panel composition may vary, but typically includes the original translator, health experts, and specialists in instrument development and translation. Professional and content experts are enlisted to ensure the questionnaire items are suitable for respondents (Koršňáková et al., 2020).

Table 3.3
List of Expert Review

No.	Education	Title	Working Place
1.	Degree	Education Service Officer	Kelantan State Education Department
2.	Degree	Excellent Teacher (GC) PJ DG48	SMK Padang Tembak Kuala Lumpur
3.	Degree	Excellent teacher (GC) BM DG52	Maktab Sultan Ismail Kota Bharu, Kelantan
4.	PhD	Technical Head	Teaching and e-learning Resource Center (PSPe) Department of Academic and International Affairs Universiti Malaysia Pahang AlSultan Abdullah
5.	PhD	Senior Lecturer	Senior Lecturer, Department of English Language and Literature, Faculty of Language and Communication, Universiti Pendidikan Sultan Idris.
6.	PhD	Lecturer	Lecturer, Faculty of Computing and Meta-Technology, Sultan Idris University of Education.

Content experts have reviewed and made corrections to the questionnaire, as shown below:

Table 3.4
Content Experts Have Reviewed and Made Corrections to the Questionnaire

Initial Construct Items	Correction made by a content expert
1. Gamification that I use in class for PE subjects is Quizizz/Kahoot/Word Wall and others. <i>Gamifikasi yang saya gunakan dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz/Kahoot/Word wall dan lain-lain.</i>	Quizizz/Kahoot/Word wall/other gamification tools are used in my PE classes. <i>Quizizz/Kahoot/Word wall/alat gamifikasi lain digunakan dalam kelas Pendidikan Jasmani saya.</i>
2. The time allocated for the online quiz is sufficient. <i>Masa yang diperuntukkan untuk kuiz dalam talian adalah mencukupi.</i>	The online quiz's time allocated is sufficient. <i>Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.</i>

The primary objective of the expert evaluation is to gather content validity evidence to confirm that the items designed for the instrument accurately reflect the construct. The subject experts evaluated the content validity of the instrument items, and their judgments were compiled into CVIs (Content Validity Indexes) (McCoach et al., 2013; Yusoff, 2019). Expert evaluation can highlight a component of the research's

nature that the researcher neglected to include in the item pool (DeVellis, 2016). In this light, valid data based on instrument content should be prioritized early in the instrument development process (DeVellis, 2016; McCoach et al., 2013). The expert review can enhance the instrument's content validity, which indicates how closely various components of an assessment tool relate to and reflect the intended concept for a particular assessment goal (Yusoff, 2019).

According to Di Iorio (2005), the CVI of the scale used must be able to provide a brief overview of the construct and theoretical definition, a description of the scale that includes several scoring and items, an actual copy of the scale that the sample must answer, and a method of evaluating to ensure that the expert panel can provide an adequate assessment. There are different types of measures available for the evaluation form: 1 means the item is irrelevant to the measured domain, 2 means it is slightly relevant, 3 means it is somewhat relevant, and 4: means it is highly relevant to the measured domain. According to Di Iorio (2005), to compute the CVI from more than two experts, the first step is to determine each expert's percentage, then add them and divide by the number of experts used. Based on the previous study's recommendations, this study recruited a panel of six experts to assess the content validity of the developed instrument. According to Grant & Davis (1997), content experts should be highly knowledgeable about the research goal, familiar with the steps involved in achieving the research objectives, and have 10 years of experience in that field.

Table 3.5
Value of the Content Validity

Expert Panel	Percentage
Expert 1	76.74 %
Expert 2	97.67%
Expert 3	100%
Expert 4	100%
Expert 5	97.67%
Expert 6	100%

The total value of the percentages from each expert is 572.08%, and this is divided by the total number of experts. The value is 0.96, which is the content validity for this instrument. According to Yusoff (2019) and Polit et al. (2007), a minimum value

of 0.83 is required to accept a CVI involving six experts; thus, the value of this CVI was accepted in this study.

3.3.7 Pre-Pilot Testing

Pre-pilot testing with a small sample of respondents or participants is the next step in creating an instrument. Pre-pilot testing is crucial to ensure that respondents clearly understand the item. The target samples are those the scientists intend to measure. Cognitive interviewing is a survey design technique used to understand how respondents read and respond to survey questions (McCoach et al., 2013). Additionally, pre-pilot testing allows respondents to provide feedback on the items' readability and content (Kalkbrenner, 2021). It is essential to conduct pre-pilot testing to ensure the target sample later used understands the generated item clearly. The researchers identified the item that was unclear and confusing to the sample through pre-pilot testing.

The pre-pilot testing involves fewer respondents than the pilot study. The range of respondents that can be used should be between 5 and 10 (McCoach et al., 2013), while Cantabrana et al. (2019) recommended 30 or more samples. According to Junyong (2017), a sample size of 10-15 can significantly improve dependability and problem detection. For this study, the researcher selected six PE teachers: three from rural and three from urban schools. The rural schools were SK Bkt Badong, SMK Dato Harun, and SMK Pengkalan Permatang, while the urban schools comprised SK Tanjong Karang, SK Saujana Utama Ijok, and SMK Seri Tanjung. The pre-pilot study involved reviewing the item and discussing improvements needed to enhance the suitability of the digital skills questionnaire for PE teachers.

Two methods can be used to conduct the pre-pilot study: the Think Aloud method and the Verbal Probe Method. In the think-aloud method, the researcher asked the sample PE teachers to think aloud while they answered the item. Then the researchers ask the sample what they think when they answer. In the verbal probe method, the researcher prepares the question in advance. For example, when the sample is answering the item, the researcher asks whether they understand certain words or what they think of the words in the question. This process can help the researcher pinpoint each item related to the sample or determine which items are not related. The researcher decides to combine each method to gather relevant information for the

instrument development process. Furthermore, the researcher used several guidelines based on the recommendations of previous scholars,

3.3.7.1 Identifying Problems

In the context of developing a questionnaire for assessing teachers' digital skills in Malaysia, during the pre-pilot, several teachers mentioned that they found some terms like "asynchronous learning platforms" confusing. This feedback allows the researcher to rephrase or define these terms to improve clarity before the main study (De Vaus, 2020).

3.3.7.2 Assessing Content Validity

In creating the survey on digital skills for PE teachers, the researcher included several questions about general computer use. During the pre-pilot, respondents suggested adding questions on sports-related technology (e.g., fitness-tracking apps). This feedback helped ensure that the survey items fully represent the unique skills relevant to PE teachers (DeVellis, 2016; Shrotryia & Dhanda, 2019; Tsang et al., 2017)

3.3.7.3 Estimating Time

The 43-question survey was anticipated to take 30-60 minutes. In the pre-pilot, however, the respondents took closer to 1 hour and 30 minutes to complete it. The researcher recognizes that some questions are too complex and decides to simplify or reduce the number of questions to fit the intended time frame (De Vaus, 2020).

3.3.7.4 Gathering Feedback on Question Sensitivity and Relevance

After pre-piloting the questionnaire on teachers' technology use, some respondents mentioned that specific questions feel overly personal or irrelevant. With this feedback, the researcher adjusted or removed questions that may cause discomfort, improving engagement and response accuracy in the main study (Majid, 2018).

3.3.7.5 Testing Data Collection Tools and Response Formats

A Likert scale question assessing the respondents' comfort with various digital tools seems ineffective during the prepilot, as many teachers chose "neutral." To address this, the researcher added more detailed response options to encourage specificity, such as "Not familiar," "Somewhat familiar," "Confident," and "Expert level." This adjustment helps capture more accurate data on teachers' digital comfort levels (Gorard, 2017).

3.3.7.6 Checking Participant Engagement and Interest

PE teachers report during the prepilot that they lose interest in sections on advanced educational software, as they rarely use complex tech in their teaching. The researcher simplified or removed these questions and instead focused on tools commonly used in PE, such as video playback for game analysis and fitness-tracking apps, to maintain teachers' interest and engagement (Almalki, 2016).

3.3.7.7 Ensuring Ethical Considerations Are Met

During the pre-pilot, PE teachers expressed discomfort about questions regarding their digital skills, fearing that lower proficiency could impact their professional evaluation. To address this, the researcher included a confidentiality statement emphasizing that responses are anonymous and strictly for research purposes, reassuring teachers of their privacy (Ishtiaq, 2019).

3.3.7.8 Testing Data Analysis Feasibility

In a preliminary analysis of pre-pilot data, responses to a question about PE teachers' use of "online collaboration tools" show limited variability. This indicates the need for more detailed questions about specific types of collaboration tools, such as "sharing instructional videos with students" or "tracking students' fitness data," to capture a fuller range of digital tool use (Gorard, 2017).

3.3.7.9 Confirming Language and Readability Levels

During the pre-pilot, PE teachers noted that some digital terminology is difficult to understand. The researcher provides explanations and examples for terms like “cloud storage” (e.g., “saving documents on Google Drive”) and “digital learning resources” (e.g., “online workout videos”), ensuring all respondents have a clear understanding of the terms used, regardless of their digital literacy level (Willis, 2005).

Table 3.6

Below Are Some Examples Found from The Pre-Pilot Process

Initial Construct Items	Correction made by a content expert
1. Gamification that I use in class for PE subjects is Quizizz/Kahoot/Word Wall, and others.	Quizizz/Kahoot/Word wall/other gamification tools are used in my PE classes.
2. The time allotted for the online quiz is sufficient.	The online quiz's time allocated is sufficient.
3. I find it very easy to learn things by using digital devices.	I find it easy to learn something by reading from digital devices.
4. I use the website to help my teaching in the subject of Physical Education	I use websites to support my teaching in PE subject.
5. I fairly evaluate each homework that students turn in using the online application.	I fairly evaluate each homework that students turn in using the online application.
6. I can create a basic Word Document for my teaching and facilitation (PdPc) purposes	I get to create a basic Word Document for my teaching and facilitation (PdPc) purposes.
7. I was able to find information on the subject of PE using a web search engine for teaching and facilitation purposes (PdPc).	I can search for information on PE subject using a web search engine for teaching and facilitation (PdPc).
8. I was able to find information on the subject of PE using a web search engine for teaching and facilitation purposes (PdPc).	I can search for information on PE subject using a web search engine for teaching and facilitation (PdPc).
9. I find it easy to find a website I visited before.	I find it easy to find websites that I have visited before.
10. I can use media devices such as laptop, handphone, and computer as teaching aids (BBM/ABM) for PE subjects.	When I use the internet to research that topic related to physical education, I feel very motivated.
11. I can use different sources of information such as Google/YouTube/ Yahoo! for PE subjects.	I can use different sources of information, such as Google/YouTube/ Yahoo!, on the subject of Physical Education.
12. I can use media devices to communicate with students.	I can use various devices to communicate with students.
13. I can create media content by using PowerPoint/ Microsoft Word /Google Meet for PE subjects	I can produce media materials by using PowerPoint/ Microsoft Word /Google Meet for PE subjects.

Initial Construct Items	Correction made by a content expert
14. Through online media platforms, I share the personal media that I create, such as digital art, with my students	Through online media platforms, I share personal media that I create, like digital art, with my students.
15. I collectively, with other PE teachers , build digital instructional tools for my students.	I am collectively building a digital instructional tool for my students with other PE teachers.
16. I employ image editing applications to adapt audio-visual material to my online teaching and facilitation (PdPc) purposes.	I use image editing applications to adapt audio-visual materials to my online teaching and facilitation (PdPc) purposes.
17. I learn how to use media platforms for developing digital educational content by watching online tutorials	I learned how to use media platforms to develop digital educational content by watching online tutorials.
18. I always keep the source of any data I obtain from any platform on my digital devices.	I always save the data I get from various platforms as documents on my digital devices.
19. I can make any changes to information during online teaching for PE subject on my digital device.	I can make any information changes during online teaching for PE subject on my digital devices.
20. I know how to use emoji.	I know how to use emoticons.
21. To avoid physical harm, I keep track of how much time I spend online	I am mindful of the amount of time I spend online to avoid physical harm.
22. I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression.	I am aware of the health risks associated with technology abuse, such as obesity/vision impairment/depression.

3.3.8 Pilot Study

A pilot study is the initial step in a research process and is usually a small-scale study that allows for planning and adjustment before the primary research begins. In other terms, a pilot study is a “small-scale research or trial run done in preparation for the major study.” (Junyong, 2017). Conducting a pilot study may warn that the primary research will fail (Wadood et al., 2021). Conducting a pilot study can save time and money by providing sufficient data to proceed with the actual research. The purpose of this pilot study is to determine the validity and reliability. The reliability and validity of the Digital Skills Instruments for PE teachers in Selangor were tested using Cronbach’s alpha and Exploratory Factor Analysis (EFA). In addition, the reliability and validity of the instruments were further strengthened through Confirmatory Factor Analysis (CFA) to establish construct validity.

The number of samples for validity and reliability varied based on other scholars' recommendations. As for validity, Jr et al. (2018) suggested a sample-to-variable ratio of 15 or 20 samples per variable. For example, if the variables are 5, the

number of samples is 100, with a ratio of 20 per variable. On the other hand, Costello & Osborne (2005) suggest 20 samples per item. Meanwhile, Kline (1994) pointed out at least 100 samples. In terms of reliability, the number of samples indicated by Conroy (2018) and Bujang et al. (2024) is 30. He also suggested that if the first item has eigenvalues less than 6, then 30 samples are not sufficient for the reliability test. If the value is between 3 and 6, then the proper sample size is at least 75. This suggestion contrasts with that of Yurdugül (2008), who stated that the minimum sample size for eigenvalues between 3 and 6 is 100. Therefore, in a pilot study, 102 male and female PE teachers participated in determining the items' validity, as suggested by Kline (1994), and 100 samples assessed the items' reliability, as mentioned by Conroy (2018) and Bujang et al. (2024).

3.4 Exploratory Factor Analysis

The Exploratory Factor Analysis (EFA) was used to determine the validity of the items in the initial steps of analysis. Exploratory Factor Analysis comprises a set of methods for explaining the relationships between variables in more basic entities known as factors. It originated from the finding that variables from a precisely defined domain, such as human ability tests or interpersonal functioning measures, are frequently associated (Costello & Osborne, 2005). Additionally, Cronbach's Alpha will be used to determine the reliability. This study's sample is taken from rural and urban areas in Selangor. Klang, Gombak, Hulu Langat, Hulu Selangor, Kuala Langat, Kuala Selangor, Petaling Utama, Petaling Perdana, Sabak Bernam, and Sepang comprise the ten districts of Selangor. According to the Department of Statistics of Malaysia (DOSM, 2021), an urban area is defined as gazetted areas with adjacent built-up areas that have a combined population of 10,000 or more people belonging to a specific development area that can be identified, with at least 10,000 people living there and at least 60% of them (those aged 15 and up) participating in non-agricultural activities. Conversely, places with fewer than 10,000 residents are considered rural areas.

Hence, this study refers to Jabatan Pendidikan Negeri Selangor JPN. Five districts have been selected as the urban and rural areas in Selangor. There are the Petaling Utama District, Petaling Perdana District, Kuala Selangor District, Klang District, and Hulu Langat District. A total of 33 schools from the four districts have been randomly selected. In this study, for the urban area, SMK Taman Dato' Harun,

SMK Damansara Jaya, SMK Damansara Utama, SMK Bandar Utama Damansara 3, SMK Bandar Utama Damansara 2, SMK Katholik (M), SMK (P) Sri Aman, SMK Taman Sea, SK Bandar Utama Damansara 4, SK Bandar Utama Damansara 2, SJK(C) Yuk Chai, SJK (C) Puay Chai and SMK Seksyen 11, Shah Alam, SMK Seri Tanjung, SMK Dato Harun, SMK Pengkalan Permatang, SMK Saujana Utama, SK Dato' Maharaja Lela, SK Kuala Selangor, SMK Meru, Klang, SMK Kota Kemuning, SMK Tengku Ampuan Rahimah, SK Sungai Binjai, and SK Taman Gembira were chosen. In contrast, SK Dato Manan, SK Jalan Raja Musa, SK Parit Empat, SMK Tiram Jaya, SMK Pulau Ketam, SK Sungai Tekali, SK Sungai Lui, SK Ulu Semenyih, and SJK (C) Choon Hwa were chosen for the rural area.

For this research, EFA was used to condense many observed variables (items) into a smaller number of variables that reflected their interrelationships. As a result, in the Development of Digital Questionnaires Among PE Teachers in Selangor, researchers used EFA to assess whether the items are related to one another and to identify weak items. The survey consisted of 43 items, each completed by every respondent. A total of 102 respondents participated, and the collected data were inputted into SPSS for analysis.

The Kaiser-Meyer-Olkin (KMO) test, a measure of sampling adequacy, assesses whether the data are suitable for factor analysis by indicating the proportion of variance explained by underlying factors. In the output, the KMO value is .772, which, upon comparison with values, is deemed acceptable. Referring to (Tabachnick & Fidell, 2007), it is advised that the Kaiser-Meyer-Olkin value $>.6$ is considered acceptable to conduct factor analysis and Bartlett's Test of Sphericity (BTS) based on $\alpha=.05$. The test statistics are significant at $p<.001$

Table 3.7
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.772
Bartlett's Test of	Approx. Chi-Square	898.171
	df	136
	Sig.	<.001

In factor analysis, SPSS helps determine the Total Variance Explained (TVE). Table 3.8 displays eigenvalues, percentages of variance, and cumulative percentages,

which are crucial in defining the number of components associated with the questionnaire.

Table 3.8
Eigenvalues, Percentages of Variance, and Cumulative Percentages
Total Variance Explained

Component	Total	Initial Eigenvalues		Extraction Sums of Squared Loadings		
		Variance %	% of Cumulative	Variance %	% of Cumulative	Total
1	5.454	32.082	32.082	5.454	32.082	32.082
2	2.769	16.288	48.369	2.769	16.288	48.369
3	1.792	10.540	58.910	1.792	10.540	58.910
4	1.542	9.068	67.978	1.542	9.068	67.978
5	.845	4.969	72.947			
6	.761	4.479	77.426			
7	.621	3.655	81.081			
8	.557	3.279	84.360			
9	.488	2.868	87.228			
10	.441	2.595	89.823			
11	.385	2.264	92.087			
12	.312	1.834	93.921			
13	.282	1.661	95.582			
14	.245	1.442	97.024			
15	.207	1.216	98.240			
16	.175	1.032	99.272			
17	.124	.728	100.000			

Extraction Method: Principal Component Analysis.

Based on the findings, 4 constructs have eigenvalues greater than 1, accounting for a cumulative percentage of 67.87%. Wadood et al. (2021) suggested that at least 50% of the total variance is explained by the retained variables when determining the number of components. Another method was the scree plot, which is commonly used to determine the number of factors or components to retain in Exploratory Factor Analysis (EFA). This plot presents a line graph of factor eigenvalues against component numbers. The figure below indicates that the curve's slope determines the number of factors to be generated in factor analysis. In this case, the plot yielded 5 components from SPSS data.

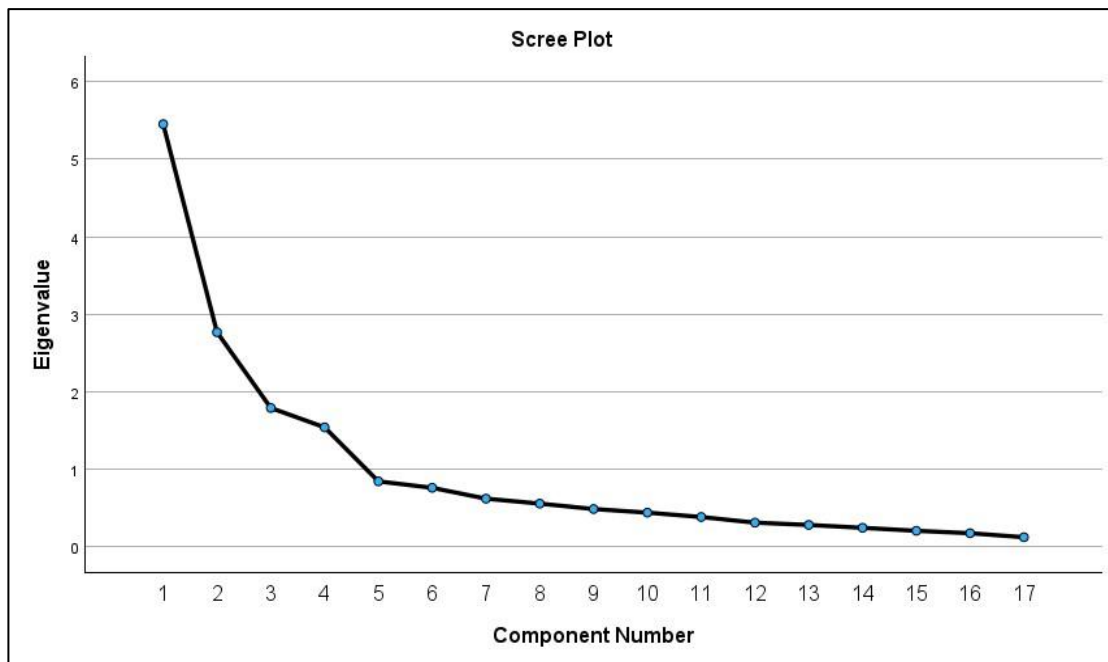


Figure 3.2 Scree Plot

According to Dabbagh et al. (2023), the TVE and Scree Plot can be used to determine how many components should be retained. While the scree plot approach uses a graphical representation of eigenvalues, the Kaiser criterion allows retaining eigenvalues greater than 1 for interpretation (Jr et al., 2018; McCoach et al., 2013). The Scree plot, which visually inspects a graphical representation of the eigenvalues for breaks or discontinuities, is another widely used technique for determining the number of factors to retain (Taherdoost, 2018). A two-dimensional grid called a scree plot has eigenvalues on the y-axis and factors on the x-axis. The variance-explained criteria, on the other hand, retain the number of factors that achieve a certain percentage of the extracted variance. To determine the cut-off point for the Scree plot, the shape of the resulting curve is used to plot the latent roots against the number of factors as they are extracted. Starting with the first factor, the plot initially slopes steeply downhill before gradually flattening out to form a roughly horizontal line. This point of inflection is often called the "elbow." The curve's initial straightening-out point is thought to reflect factors with more unique than common variance, making them less suitable for retention (Jr et al., 2018; McCoach et al., 2013). Therefore, this study decided to use TVE to determine which components need to be retained. According to Wadood et al. (2021), at least 50% of the total variance should be explained by the retained variables when determining the component numbers. However, based on (Hair et al., 2010), the value of TVE that is accepted is 60%. Another suggestion is only 75% or above, as claimed

by Beavers et al. (2013). The researcher retained 4 components, corresponding to 67.98% based on the recommendation by Hair et al. (2010).

The data collected from the pilot study were used to determine factor loadings in SPSS, which are often reported as the rotated component matrix. This analysis helps ascertain what the components represent in the research. Previous research, such as that by Sum et al. (2016), suggested that acceptable loading values should exceed 0.50 to relate items to the questionnaire components. 43 items were initially identified, but only 17 showed factor loadings greater than 0.50. Jr et al. (2018) suggested that the practical significance of factor loadings of 0.5 or greater should be considered. If the sample size is 100 or above and the focus is on practical rather than statistical significance, then these principles apply. Hence, the value of factor loading that is accepted is 0.50 based on the above factor that has been discussed. A value of 0.5 is also recommended by Tabachnick & Fidell (2007) as an ideal value for EFA.

Consequently, 26 items were excluded from the construct due to their low loadings, indicating irrelevance and redundant factors within the components.

Table 3.9
Rotated Component Matrix

	Component			
	1	2	3	4
TLA_1	.801			
TLA_4.	.769			
TLA_3	.759			
TLA_2.	.752			
TLA_5	.723			
TLA_6	.660			
IDL_4		.879		
IDL_1		.850		
IDL_3		.688		
IDL_2		.687		
CC_1			.862	
CC_4			.790	
CC_3			.786	
CC_2			.763	
CDC_1				.876
CDC_2				.871
CDC_3				.731

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 5 iterations.

The Cronbach's Alpha value obtained for this instrument surpasses .70, indicating its reliability falls within an acceptable range. Initially comprising 43 items, with 4 to 8 items per component, reliability testing was conducted to assess item suitability within the constructed instrument.

The table below presents reliability statistics for each component, along with the number of items in each component. It is crucial to establish adequate intercorrelation among variables for conducting EFA. Intercorrelations between items gauge the relationship between scores on one item and those on other items within the entire scale. The ideal average intercorrelation for a set of items typically ranges from 0.2 to 0.4, signifying reasonable homogeneity (Watkins, 2018). However, Pretorius et al. (2023) suggested that an average inter-item correlation of 0.15-0.5 meets the criteria for a good scale.

Table 3.10
Cronbach Alpha

Component	Cronbach Alpha	No. of Items
Teaching Learning and Assessment	0.863	6
Creation of Digital Content	0.817	3
Information and Data Literacy	0.850	4
Communication and Collaboration	0.818	4
Total Items	0.817	17

The number of items in each construct varied. The Teaching Learning and The Assessment construct consists of 6 items: Information and Data Literacy (4 items), Creation and Digital Content (3 items), and Communication and Collaboration (4 items). According to (Hair et al., 2010), at least 3 items are considered adequate in the CFA measurement model. This statement is also supported by Tabachnick and Fidell (2007), in which a construct needs to have 3 variables or items. Raubenheimer (2004) also suggested that a minimum of three items is required for the model to exhibit sufficient reliability and validity. Therefore, it can be concluded that the number of items in each construct in the measurement model can be used relevantly for the sample of PE teachers in Selangor. Thus, this measurement model employed CFA analysis to make sure the instrument is more comprehensive.

3.5 Confirmatory Factor Analysis

Researchers often use CFA to test a hypothetical model of a system they propose when examining relationships between concepts. CFA assists in identifying the anticipated factor structure that describes the phenomena. CFA's primary goal is to verify if the number of factors and the relationships between observed variables align with theoretical expectations (Sureshchandar, 2023). Ensuring accurate representation of constructs by observed variables necessitates assessing scale reliability and validity. Xiao et al. (2019) suggested using descriptive categories from unacceptable (0 to 0.49) to excellent (0.9 to 1) to aid interpretation of internal consistency levels.

In Confirmatory Factor Analysis (CFA), two pivotal models warrant examination: the measurement model and the structural model. The measurement model delves into the connections among constructs, indicators, and the intended constructs they represent (i.e., factors). Researchers analyze three crucial outcomes—parameter estimates, fit indices, and, if applicable, modification indices—to formally assess measurement hypotheses. This evaluation allows researchers to refine hypotheses to better align with the scale's responses. Therefore, initiating the process by delineating the measurement model holds utmost importance.

Three types of validity must be demonstrated to consider an item's fit: Construct Validity, Convergent Validity, and Discriminant Validity. In construct validity, it needs to determine whether the construct achieved the three Model Fit categories: Absolute Fit, Incremental Fit, and Parsimonious Fit. Table 3.11 shows the three categories and their acceptance:

Table 3.11
Three Categories of Model Fit and Level of Acceptance

Name of Category	Name of Index	Level of Acceptance
Absolute Fit Index	RMSEA	RMSEA < 0.08
	GFI	GFI > 0.90
Incremental Fit Index	AGFI	AGFI > 0.90
	CFI	CFI > 0.90
	TLI	TLI > 0.90
	NFI	NFI > 0.90
Parsimonious Fit Index	Chisq/df	Chi-Square/df < 3.0

***The indexes in bold are recommended since they are frequently reported in the literature
Source: (Zainuddin Awang, 2015).

The Average Variance Extracted (AVE) must exceed 0.5, considered the threshold for convergent validity (Zainuddin Awang, 2015), to determine convergent validity. On the other hand, for composite reliability (CR), a value above 0.6 for all constructs is considered acceptable (Z. Awang, 2015). Discriminant validity is another form of model validity that the researcher must evaluate. According to Awang Zainuddin (2014), a construct has discriminant validity if the square root of its AVE is greater than the correlation with other constructs in the model. As for reliability, it is adequate for the study to assess Composite Reliability (CR), as it replaced the traditional Cronbach's Alpha for Structural Equation Modeling (SEM) analyses (Verra et al., 2006). The Composite Reliability should exceed the threshold of 0.6 to be considered achieved (Zainudin Awang, 2015).

3.6 Population

The term "population" refers to a specific set of people the researcher classifies according to their areas of interest, and the outcome can be generalized (Acharya et al., 2013). Additionally, Ishtiaq (2019) defined a population as "a group of individuals who share a common trait." This study's population consists of PE teachers in Selangor. Male and female PE teachers from 33 rural and urban schools in Selangor, randomly selected across several districts, comprise the study's population. Simple random sampling was utilized in this investigation because it is the most cost-effective and essential probability sampling approach used in the actual research (Acharya et al., 2013).

3.6.1 Sample Size

Sampling involves selecting a representative subgroup, or sample, from the larger population. This method enhances the accuracy and cost-effectiveness of research. The degree of generalisability of study findings is greatly influenced by the sampling strategy used. PE teachers from rural and urban schools in Selangor comprised the sample for this study. The five types of probability sampling are simple random sampling, systematic sampling, stratified sampling, cluster sampling, and multistage sampling (Zainudin Awang, 2015). In this study, simple random sampling was used, and everyone had an equal chance of participating. This design was used to generalize

to the population, which is impossible with non-probability sampling. In other words, the sample representative cannot be questioned. In line with Acharya et al. (2013), this approach has good internal and external validity, requires little demographic information, and makes data analysis easy. For this research, a cross-sectional study was undertaken among PE teachers in Selangor.

It is crucial to identify an adequate sample size of respondents to ensure the research findings will be helpful to. Hence, several approaches can be used to determine the sample size for the population using Cohen's Statistical Power Analysis (Brydges, 2019). Cohen's Statistical Power Analysis is often used in the behavioral sciences to calculate sample size. Cohen (1988) explained that statistical power analysis exploits the relations among five factors involved in statistical implications. For the most part, the sample size for a given statistical test is determined by specifying values for the other four factors, such as the significance level, effect size, desired power, and estimated variance (Penyelidikan, 2006).

In reference to (Cohen, 1970), statistical power denotes the probability that a test will reject the null hypothesis by assuming there is an actual effect of a given size, and it commonly varies as a function of effect size (ES), sample size, and alpha level (Brydges, 2019). Besides that, in a previous study by (Penyelidikan, 2006), the recommended factors to estimate an adequate sample size for research are the alpha level is set at .05, the effect size is moderate, and the power is set at .80. Besides that, (Hair et al., 2010) recommended a minimum sample size of 100 respondents for CFA if there are five or fewer latent components and each latent construct contains more than three items. By considering four components in the measurement model, this study used Hair et al. (2010) suggestion of at least 100 respondents to meet the CFA sample size requirement.

Table 3.12
Cohen's Statistical Power Analysis

Sample size based on power and effect size			
N for Small, Medium and Large ES at Power = .80 for α = .01, .05, and 1.0			
Test	Sm	α	
		0.5	
ANOVA		Med	Lg
2g ^a	393	64	26
3g ^a	322	52	21

4g ^a	274	45	18
5g ^a	240	39	16
6g ^a	215	35	14
7g ^a	195	32	13

Cohen (1992) recommended a sample size based on power and effect size, as seen below. As there are six independent variables and a 0.5 significance level in this social science investigation, a sample size of at least 100 respondents is required. By considering four components in the measurement model, Hair et al. (2010) suggested that at least 100 respondents are needed to meet the CFA sample size requirement. However, regarding the mortality factor, the researcher decided to take 110 samples, as some participants may not be able to continue the study. It can aid the researcher in identifying potential outliers and missing data, and obtaining complete and honest responses from respondents.

The rural and urban areas consist of uneven numbers of schools. The rural area consists of nine schools, whereas the urban area consists of twenty-four schools. The number of samples will be determined based on the number of schools in rural and urban areas, ensuring balanced sampling by proportional allocation. According to Singh (2006), proportional sampling ensures that smaller or less frequent subgroups are not underrepresented in the sample, particularly in diverse populations. This study employed proportional sampling to provide a representative selection of teachers from rural and urban schools. First, to calculate proportional sampling, the number of PE teachers to be used by school type should be identified, as these numbers are not balanced. To determine the number of PE teachers needed in each rural or urban area, divide the number of schools in that area by the total number of schools in the state. For example:

$$\frac{\text{Urban School (24)}}{\text{Total School between rural and urban (33)}} \times 110 \text{ sample}$$

The total sample number of PE teachers in urban areas is 80, and 30 in rural areas. The study included 110 PE teachers, of whom 30 were selected from rural schools and 80 from urban schools. To determine the number of teachers to be chosen from each school, the proportion of teachers in each school was calculated based on the total

number of teachers in the rural and urban areas. The equation for the proportional sampling is below:

For example, the total number of teachers at the rural school, SMK Damansara Jaya, was 63, and at the urban school, 2286. The equation to calculate the sampling is:

$$\frac{SMK\ Damansara\ Jaya\ (63)}{Total\ teachers\ in\ an\ urban\ area\ (2286)} \times 80$$

This led to the selection of 2 teachers from SMK Damansara Jaya for the urban sample. The same proportional method was applied to other schools to determine the number of teachers from each school, ensuring that the sample accurately reflects the distribution of teachers across rural and urban schools. The table below presents the number of samples from the rural and urban schools.

Table 3.13
Urban Sample

Urban Schools	District	Total	Sample
1. SMK Taman Dato' Harun	Petaling Perdana	110	4
2. SMK Damansara Jaya	Petaling Utama	63	2
3. SMK Damansara Utama	Petaling Utama	57	2
4. SMK Bandar Utama Damansara 3	Petaling Utama	63	2
5. SMK Bandar Utama Damansara 2	Petaling Utama	56	2
6. SMK Katholik (M)	Petaling Utama	145	5
7. SMK (P) Sri Aman	Petaling Utama	59	2
8. SMK Taman Sea	Petaling Utama	83	3
9. SMK Seksyen 11, Shah Alam	Petaling Perdana	39	1
10. SMK Seri Tanjung	Kuala Selangor	90	3
11. SMK Dato Harun	Kuala Selangor	80	3
12. SMK Pengkalan Permatang	Kuala Selangor	77	3
13. SMK Saujana Utama	Kuala Selangor	223	8
14. SMK Meru, Klang	Klang	240	8
15. SMK Kota Kemuning	Klang	171	6
16. SK Dato' Maharaja Lela	Kuala Selangor	94	3
17. SK Kuala Selangor	Kuala Selangor	30	1
18. SK Bandar Utama Damansara 4	Petaling Utama	53	2
19. SK Bandar Utama Damansara 2	Petaling Utama	31	1

Urban Schools	District	Total	Sample
20. SJK(C) Yuk Chai	Petaling Utama	139	5
21. SJK (C) Puay Chai	Petaling Utama	84	3
22. SMK Tengku Ampuan Rahimah	Klang	84	3
23. SK Sungai Binjai	Klang	179	7
24. SK Taman Gembira	Klang	36	1
TOTAL		2286	80

Table 3.14
Rural Sample

Rural Schools	District	Total	Sample
1. SMK Tiram Jaya	Kuala Selangor	57	6
2. SMK Pulau Ketam	Klang	28	3
3. SK Dato Manan	Kuala Selangor	46	5
4. SK Jalan Raja Musa	Kuala Selangor	18	2
5. SK Parit Empat	Kuala Selangor	30	3
6. SK Sungai Tekali	Kuala Selangor	28	3
7. SK Sungai Lui	Hulu Langat	16	2
8. SK Ulu Semenyih	Hulu Langat	47	5
9. SJK (C) Choon Hwa	Hulu Langat	10	1
TOTAL		280	30

This study also examined gender differences among PE teachers in Selangor. The proportional sampling method was also used to determine the number of male and female teachers to be included in the study. The sample calculation for teachers of both genders is as follows:

$$\frac{SMK Damansara Jaya (Total Male Teachers) (12)}{Total teachers SMK Damansara Jaya (63)} \times 2 \text{ sample needed}$$

Table 3.15
Urban Sample Based on Gender

Urban Schools		District	M	F	Total	Sample Male	Sample Female
1.	SMK Taman Dato' Harun	Petaling Perdana	24	86	110	1	3
2.	SMK Damansara Jaya	Petaling Utama	12	51	63		2
3.	SMK Damansara Utama	Petaling Utama	9	48	57		2
4.	SMK Bandar Utama Damansara 3	Petaling Utama	9	54	63		2
5.	SMK Bandar Utama Damansara 2	Petaling Utama	11	45	56		2
6.	SMK Katholik (M)	Petaling Utama	24	121	145	1	4
7.	SMK (P) Sri Aman	Petaling Utama	9	50	59		2
8.	SMK Taman Sea	Petaling Utama	20	63	83	1	2
9.	SMK Seksyen 11, Shah Alam	Petaling Perdana	12	27	39		1
10.	SMK Seri Tanjung	Kuala Selangor	22	68	90	1	2
11.	SMK Dato Harun	Kuala Selangor	18	62	80	1	2
12.	SMK Pengkalan Permatang	Kuala Selangor	31	46	77	1	2
13.	SMK Saujana Utama	Kuala Selangor	27	196	223	1	7
14.	SMK Meru, Klang	Klang	28	212	240	1	7
15.	SMK Kota Kemuning	Klang	23	148	171	1	5
16.	SK Dato' Maharaja Lela	Kuala Selangor	26	68	94	1	2
17.	SK Kuala Selangor	Kuala Selangor	10	20	30		1
18.	SK Bandar Utama Damansara 4	Petaling Utama	17	36	53	1	1
19.	SK Bandar Utama Damansara 2	Petaling Utama	10	21	31		1
20.	SJK(C) Yuk Chai	Petaling Utama	24	115	139	1	4
21.	SJK (C) Puay Chai	Petaling Utama	10	74	84		3
22.	SMK Tengku Ampuan Rahimah	Klang	14	70	84		3
23.	SK Sungai Binjai	Klang	37	142	179	1	6
24.	SK Taman Gembira	Klang	12	24	36		1
TOTAL						13	67

Table 3.16
Rural Sample Based on Gender

Rural Schools	District	M	F	Total	Sample Male	Sample Female
1. SMK Tiram Jaya	Kuala Selangor	19	38	57	2	4
2. SMK Pulau Ketam	Klang	13	15	28	1	2
3. SK Dato Manan	Kuala Selangor	13	33	46	1	4
4. SK Jalan Raja Musa	Kuala Selangor	7	11	18	1	1
5. SK Parit Empat	Kuala Selangor	11	19	30	1	2
6. SK Sungai Tekali	Kuala Selangor	10	18	28	1	2
7. SK Sungai Lui	Hulu Langat	5	11	16	1	1
8. SK Ulu Semenyih	Hulu Langat	12	35	47	1	4
9. SJK (C) Choon Hwa	Hulu Langat	4	6	10		1
TOTAL					9	21

The study initially included 110 respondents from 33 schools across four districts in Selangor, encompassing both urban and rural areas. Using proportional sampling, the sample makeup is 110 samples, with 80 in urban and 30 in rural zones. After excluding outliers, the final sample comprised 102 PE teachers: 53 from urban schools and 49 from rural schools. The sample consists of PE teachers who are currently teaching or have prior teaching experience in PE, have over 5 years of professional experience, and have completed courses related to Physical Education. This final sample provides a well-rounded representation of PE teachers across diverse geographical and contextual backgrounds, enabling a comprehensive analysis of their digital skills.

3.7 Instrumentation

This questionnaire is divided into three sections: Section A (Demographic Information) and Section B (Digital Skills Questionnaire). The questionnaire used in this study was developed and adapted. Below is the explanation of each section:

Section A: Demographic Information

The respondents' personal data were collected in this section, where the consent form was distributed first to protect any confidential information of these PE teachers

from being leaked. The issues include the school, school category, age, gender, teaching experience, experience in attending a digital skills course, and whether the physical education subject was taught as a major or an optional subject. The age and teaching experience were assessed using closed-ended questions with a limited set of possible answers.

Section B: Digital Skills Questionnaire

In this section, 6 components of digital skills —information data literacy, communication and collaboration, creation of digital content, and teaching, learning, and assessment — among PE teachers in Selangor will be measured. The Likert scale (1=strongly disagree- 5=strongly agree) was used as a measurement scale. It consists of 4 constructs with 16 items.

3.8 Data Collection

In research, it is critical to obtain approval or permission from multiple legal authorities to ensure a smooth data collection process and to protect confidential data. Thus, several procedures were established to ensure the success of this research. First, permission was needed to be sought from the Division of Education Policy Planning and Research (EPRD), Ministry of Education (MOE), and the Ethics Committee of UiTM before conducting the data collection. A letter of approval was obtained after EPRD and MOE approved. Then, the researcher proceeded to the next step: seeking permission from the principals of the selected schools and distributing the questionnaire to both male and female PE teachers in the selected rural and urban schools. The questionnaire was distributed using simple random sampling, with male and female samples selected from primary and secondary schools in rural and urban areas of Selangor.

The respondents were assured that all data would be kept confidential and private throughout the study, and they were asked to provide their consent to participate. Each respondent was required to fill out and sign a consent form before answering the questionnaire. This consent form is necessary to conduct a study involving school students. They were required to answer all questions and return questionnaires to the researcher. A copy of the official letter from the Institute of Graduate Education (IPSIS)

was obtained, and a letter of verification from Universiti Teknologi MARA (UiTM) confirming the researcher's background was also provided.

3.9 Data Analysis

All data collected for this research were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) and IBM SPSS Amos. Descriptive statistics were used in the study, including frequency, mean (M), and standard deviation (SD), to describe the socio-demographic variables of male and female PE teachers in Selangor, from rural and urban areas. Inferential statistics will be used to analyze the data collected. Data analysis was conducted to address the research questions stated. In this study, the descriptive mean will be used to determine the level of digital skills among PE teachers in Selangor.

Table 3.17
Data Analysis

No.	Research Questions	Type of Analysis
1.	What is the construct validity evidence of the digital skills questionnaire among PE teachers in Selangor?	Confirmatory Factor Analysis
2.	What is the level of digital skills among PE teachers in Selangor?	Descriptive Mean
3.	Is there any significant difference in digital Tskills among PE teachers in urban and rural areas in Selangor?	Independent Samples Test
4.	Is there any difference in terms of digital skills between gender and age among PE teachers in Selangor?	Two-Way ANOVA
5.	Is there any difference in terms of digital skills construct between rural and urban areas among PE teachers in Selangor?	MANOVA

3.10 Normality Test

In this study, a normality test was also conducted to determine whether the sample data originated from a normally distributed population. Checking continuous variables for normality is an essential first step in practically every multivariate investigation (Tabachnick & Fidell, 2007).

There are two types of normality: parametric and nonparametric, where the former assumes the distribution is normal and the latter does not. According to Holcomb

& Cox (2018), there are various ways to analyze normality, including graphical and statistical methods. Statistical tests include the Kolmogorov-Smirnov, Shapiro-Wilk, Anderson-Darling, Jarqua-Bera, and D'Agostino skewness tests. Graphical tests include leaf plots, boxplots, and frequency histograms. The Jarqua-Bera and D'Agostino skewness tests are based on descriptive measures, whereas the Kolmogorov-Smirnov, Shapiro-Wilk, and Anderson-Darling tests are based on empirical distribution functions (EDF). The graphical approaches can be a helpful tool for figuring out whether a sample of (n) independent observations is normal, but they are not adequate to prove the normal assumption to be valid. To support graphical methods, formal normality tests, and other numerical methodologies should be employed before drawing any conclusions about the normality of the data (Kuranga et al., 2020). Data skewness and kurtosis levels can also be used to determine whether the data is normal. The Jarqua-Bera and D'Agostino skewness test has been used the most frequently to assess skewness and kurtosis (Jammalamadaka et al., 2021; Jondeau et al., 2019). There is debate over the values that denote normalcy, even though skewness and kurtosis values are routinely utilized in practice (Drerup et al., 2023). The skewness of a distribution refers to how much it is asymmetrical or skewed to the left or right. The features of distribution tails, such as their size and weight, are described by kurtosis (Chattamvelli & Shanmugam, 2023). Skewness and kurtosis absolute values below 1.0 are regarded as small non-normality, those between 1.0 and about 2.3 as moderate non-normality, and those beyond 2.3 as severe non-normality. Similar findings were reported by Jondeau et al. (2019), who found that distributions with pointed skewness between 0 and 5 are fairly symmetrical, whereas those between 5 and 1 are moderately skewed. Distributions with pointed skewness greater than 1 are severely skewed (Langlois, 2020). However, when the skewness is less than 2 and the kurtosis is not greater than 7, it is considered normal (Jammalamadaka et al., 2021). According to Drerup et al. (2023), some academics consider skewness levels above 3 to be excessive. When it comes to kurtosis levels, values over 10 are deemed problematic, over 20 are considered problematic, and over 20 are deemed highly significant (Chattamvelli & Shanmugam, 2023).

In this research, the normality of the sample data was assessed using measures of skewness and kurtosis, as recommended by Jammalamadaka et al. (2021). Specifically, the tilt range proposed by DeCarlo (1997) to indicate non-normality is higher than 7 for kurtosis. Below is the result of normality using skewness and kurtosis:

Table 3.18
Normality of Data Based on Skewness and Kurtosis

Constructs	Skewness	Kurtosis
Teaching, Learning, and Assessment	-.799	2.439
Creation of Digital Content	-.244	.126
Information Data Literacy	-.362	-.506
Communication and Collaboration	-.748	1.231

Based on the result of skewness and kurtosis, the value is normal based on a recommendation from Jammalamadaka et al. (2021), which stated that the value of skewness is under 2 and the value of kurtosis does not exceed the value of 7.

3.11 Conclusion

To summarize, this chapter explained all procedures and methodologies used to conduct this research. It justified the importance of using components of digital skills to measure their effects on the PE teachers in Selangor. The process of evaluating the questionnaire to ensure the items' validity and reliability for this research was also described. The items in this questionnaire were then analyzed and measured for validity by using factor analysis.

The sample population was estimated, and a sample size of (n=102) respondents was determined to proceed with the data collection. During this study, male and female PE teachers were selected through a convenience sampling method from four areas comprising urban and rural districts in Selangor to determine the suitable location for the research; in each location, 33 schools were chosen. The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS), from which statistics such as multiple regression were obtained. The findings will be elaborated further in the next chapter.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

In this chapter, the study's results are presented and discussed to establish the construct validity of digital skills questionnaires for PE teachers in Selangor. Furthermore, this study aims to determine the level of digital skills and the differences in digital skills among PE teachers in urban and rural areas of Selangor. There are 2 types of statistical analysis: descriptive and inferential statistics. Descriptive statistics entails gathering, analyzing, interpreting, and summarising data to present it in charts, graphs, and tables, using indices such as the mean and median to summarize the data. In contrast, inferential statistics uses statistical tests such as the t-test to draw conclusions from the data. (Sarmiento & Costa, 2019). This chapter will discuss the analysis findings based on the five research questions.

4.2 Demographic Data

The respondents' demographic data are shown below:

Table 4.1
Demographic Data

		Count	Column N %
School category	Urban	75	73.5%
	Rural	27	26.5%
Age	Below 21 Years Old	0	0.0%
	21-30 Years Old	18	17.6%
	31-40 Years Old	39	38.2%
	41-50 Years Old	38	37.3%
	51 Years Old and Above	7	6.9%
Gender	Male	20	19.6%
	Female	82	80.4%
	5 years and below	37	36.3%
	6-10 Years	16	15.7%

		Count	Column N %
How many years of teaching experience in the physical education subject?	11-20 Years	37	36.3%
	21 Years and above	12	11.8%

Demographic data were collected to guide the development of the instrument to assess the level of digital skills among PE teachers in Selangor. The demographic data include respondents' school type, age, gender, and teaching experience in physical education. The table shows the statistics of the sample based on school category. A total of one hundred and two (102) respondents were involved in this study. 73.5% (75) of respondents were from urban schools, and 26.5% (27) were from rural schools. In terms of age, 17.6% (18) aged 21-30, 38.2% (39) aged 31-40, 37.3% (38) aged 41-50, and 6.9% (7) aged 51 and above.

Regarding gender, 20 respondents (19.6%) were male, while 82 (80.4%) were female.

Lastly, the respondents' years of teaching the physical education subject are as follows: 36.3% (37) with experience of 5 years and less, 15.7% (16) with 6 to 10 years, 36.3% (37) with 11 to 20 years of experience, and 11.8% (12) with 21 years and more.

4.3 Research Question

4.3.1 Research Question 1

What is the construct validity evidence of digital skills questionnaires among PE teachers in Selangor?

4.3.1.1 The Assessment of Construct Validity

CFA was conducted to assess the construct validity of the instruments based on the six constructs used in the instruments. Figure 4.1 below presents the first-order model of Digital Skills, comprising 4 constructs and 17 items.

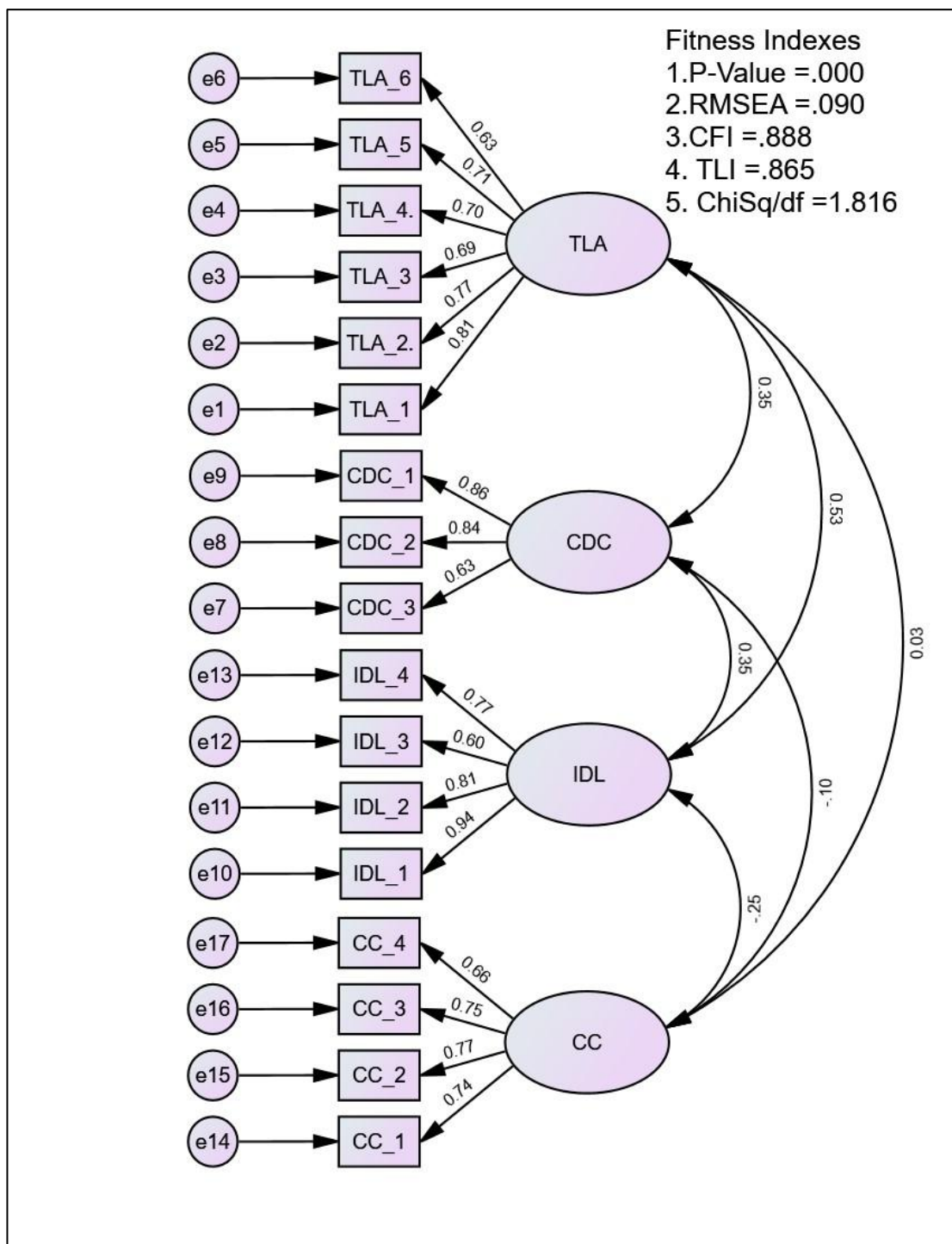


Figure 4.1 First-Order Model

Table 4.2
Covariances: (Group number 1 - Default model)

			M.I.	Par Change
e17	<-->	TLA	8.188	-.107
e15	<-->	IDL	6.913	-.063
e15	<-->	TLA	9.594	.089
e15	<-->	e17	6.422	-.075
e15	<-->	e16	4.849	.055
e14	<-->	TLA	4.426	-.060
e14	<-->	e17	18.694	.127
e12	<-->	CDC	4.729	.067
e12	<-->	e13	9.186	.074
e11	<-->	TLA	7.385	.070
e11	<-->	e13	6.539	-.043
e7	<-->	e11	9.683	.085
e5	<-->	e10	5.027	-.039
e3	<-->	e16	5.172	.076
e3	<-->	e14	4.815	-.065
e3	<-->	e5	8.005	.094
e3	<-->	e4	4.337	.091
e2	<-->	e13	6.698	.058
e2	<-->	e6	5.143	.082
e1	<-->	e16	4.422	-.060

According to Awang et al. (2023), a high MI value (i.e., exceeding 15) indicates that the items are highly correlated or redundant in the model. The researcher could select one of the following options to address the redundant items: Option 1: a. Choose the lower factor loading to remove one of the items. b. Repeat the previous procedures while running the measurement model, or select Option 2: Run the measurement model and repeat the previous steps after setting the pair of redundant items to "free parameter estimate" (a). The researcher chose to remove item CC4, as suggested. Figure 4.2 illustrates the second order of the model:

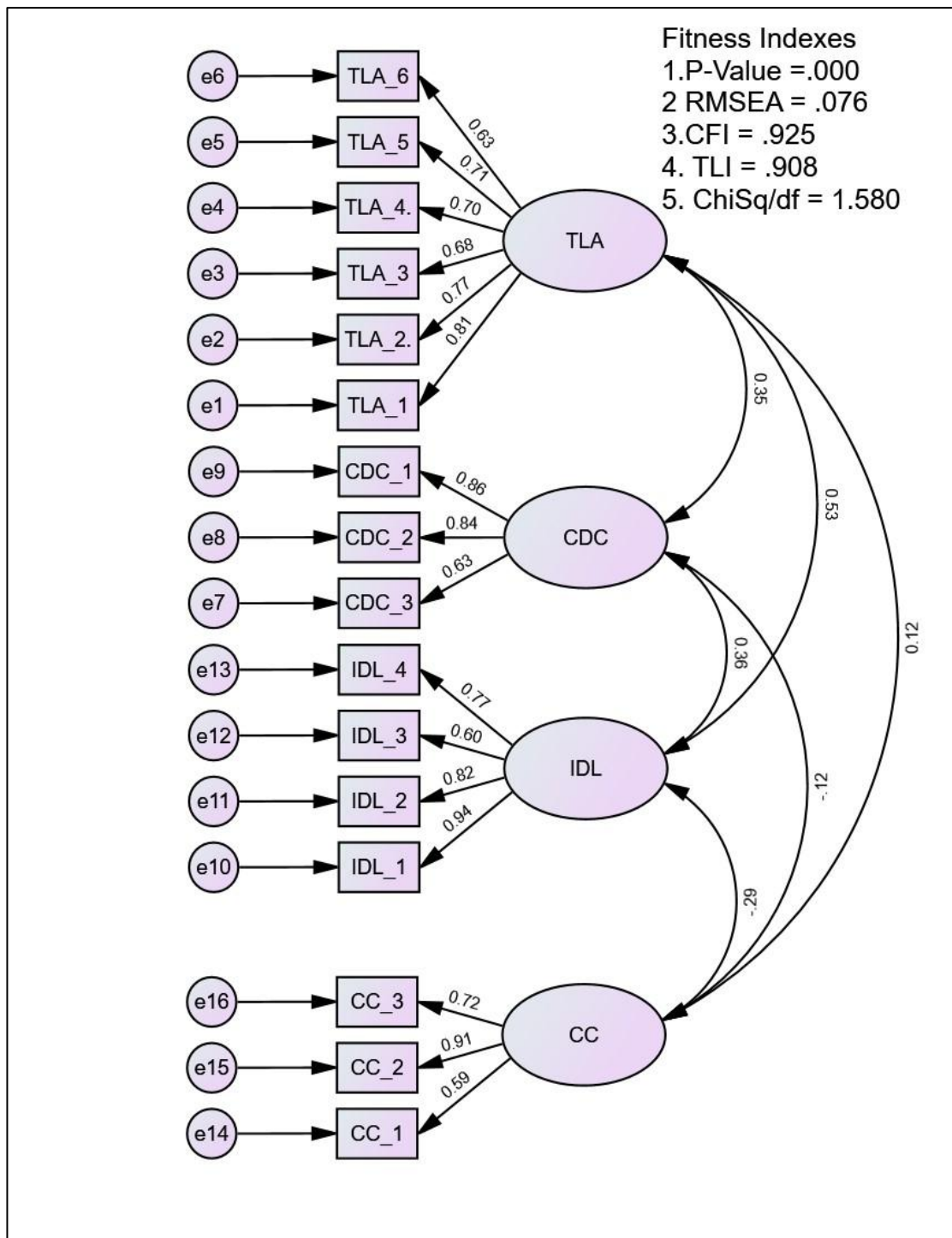


Figure 4.2 First Order Model

Three types of validity need to be passed to consider an item's fit, which are Construct Validity, Convergent Validity, and Discriminant Validity. The first step is to determine whether the construct achieved the three Model Fit categories: Absolute Fit, Incremental Fit, and Parsimonious Fit. Table 4.3: below shows the three categories and their acceptance:

Table 4.3

Presents the Three Categories of Model Fit and Level of Acceptance

Name of Category	Name of Index	Level of Acceptance
Absolute Fit Index	RMSEA	RMSEA < 0.08
	GFI	GFI > 0.90
Incremental Fit Index	AGFI	AGFI > 0.90
	CFI	CFI > 0.90
	TLI	TLI > 0.90
	NFI	NFI > 0.90
Parsimonious Fit Index	Chisq/df	Chi-Square/df < 3.0

***Due to their frequent reporting in the literature, the bolded indexes are advised

Source: Awang (2015)

The results indicate that four constructs achieved model fit. These four constructs are Teaching, Learning and Assessment, Creation of Digital Content, Information Data Literacy, and Communication and Collaboration, with RMSEA = .076 and CFI = .925, TLI=.908, and Chisq/df = 1.580.

4.3.1.2 The Assessment of Convergent Validity and Composite Reliability

The Average Variance Extracted (AVE) needs to exceed the threshold value of 0.5 to be considered ideal for convergent validity(Awang, 2014;2015; Afthanorhan et al., 2019). In the meantime, for composite reliability (CR), a value above 0.6 for all constructs is considered achievable for reliability (Mohamad et al., 2018; Awang, 2015) The AVE and CR values for the Digital Skills Constructs are computed and presented in Table 4.4.

Table 4.4

Average Variance Extracted (AVE) And Composite Reliability (CR) For All Constructs Of Digital Skills

Construct	Item	Factor Loading	CR>0.6	AVE > 0.5
TLA	TLA1	0.81	0.86	0.51
	TLA2	0.77		
	TLA3	0.69		
	TLA4	0.70		
	TLA5	0.71		
	TLA6	0.63		

Construct	Item	Factor Loading	CR>0.6	AVE > 0.5
CDC	CDC1	0.86	0.82	0.61
	CDC2	0.84		
	CDC3	0.63		
IDL	IDL1	0.94	0.86	0.62
	IDL2	0.81		
	IDL3	0.60		
	IDL4	0.77		
CC	CC1	0.74	0.82	0.53
	CC2	0.77		
	CC3	0.75		
	CC4	DELETED		

The result above shows that the AVE values for all Digital Constructs exceed the threshold value of 0.5. The constructs are Teaching, Learning, and Assessment (TLA = 0.51), Creation of Digital Content (CDC = 0.61), Information of Data Literacy (IDL = 0.62), and Communication and Collaboration (CC = 0.53). On the other hand, the value of CR for all constructs exceeds the suggested value, which is CR> 0.6 with the value of Teaching, Learning, and Assessment (TLA =0.86), Creation of Digital Content (CDC = 0.82), Information and Data Literacy (IDL = 0.86) and Communication and Collaboration (CC= 0.802)

4.3.1.3 The Assessment of Discriminant Validity among Constructs

Discriminant validity is another type of model validity that must be assessed in a study. Awang et al. (2018) stated that if a construct's square root of its AVE is higher than the correlation value with other constructs in the model, it has discriminant validity. Stated otherwise, in order to obtain discriminant validity, the diagonal values (bold) must be greater than all other values in the row and the column. Table 4.5 below shows the discriminant validity index summary for all the constructs in Digital Skills:

Table 4.5
Discriminant Validity Index For All Constructs

Construct	TLA	CDC	IDL	CC
TLA	0.71			
CDC	0.35	0.78		
IDL	0.53	0.35	0.78	
CC	0.03	-0.10	-0.25	0.72

If the diagonal values in bold are greater than any other values in its row and column, discriminant validity is attained, as the preceding table illustrates. Therefore, it can be said that all of the constructs are met because the values in Table 4.4 satisfy the discriminant validity criterion.

4.3.1.4 The Assessment of Normality of The Construct

Prior to building the structural model and doing SEM, the researcher must ascertain whether every item measuring the construct has a normal distribution. Since SEM employs the parametric statistical modeling approach, it is required to measure the corresponding concept and examine the normality distribution of each item. As argued by Awang et al. (2015), Kashif et al. (2015 2016), and Yusuf et al. (2017), a study only needs to show that the skewness values for all items are not far from normal. In the meantime, Kim (2013) highlighted the significance of kurtosis and skewness testing for a legitimate normality test, irrespective of sample size. In order to report the sample's normality test, this study used skewness and kurtosis values. Hair et al. (2010) stated that skewness values of 3 and +3 and kurtosis values of 10 and +10 are acceptable and that skewness values of -2 and +2 with kurtosis values of -7 and +7 are regularly distributed. Thus, kurtosis between -7 and +7 is acceptable, but skewness values should fall between -2 and 2. The assessment of normality distribution for all items is presented in Table 4.6.

Table 4.6
Assessment of Normality

Variable	skew	kurtosis
CC3	-.427	-1.010
CC2	-1.448	5.053
CC1	-1.532	6.268
IDL4	-.605	-.584
IDL3	-.710	.222
IDL2	-.759	.775
IDL1	-.675	.826
CDC1	-.230	-.320
CDC2	-.200	-.175
CDC3	-.510	.074
TLA6	-.516	-.014
TLA5	-.300	-.220
TLA4	-.236	-.521
TLA3	-.750	.902
TLA2	-1.200	2.648
TLA1	-.978	1.553

The values of skewness for all components in the model fall within the range between -2 and +2 with kurtosis -7 and +7, which means they are not distributed further from normality (Hair et al., 2010). Consequently, the data distribution satisfies the parametric statistical analysis's normality criteria.

4.3.2 Research Question 2

What is the level of digital skills among PE teachers in Selangor?

The descriptive mean method was employed as a statistical test to measure the level of digital skills among PE teachers in Selangor. By using the mean score interpretation by (Nunnally& Berstein, 1994), the level of digital skill is interpreted as follows:

Table 4.7
Mean Score Interpretation

Mean Scale	Level
4.01 – 5.00	High
3.01 – 4.00	Medium High
2.01 – 3.00	Medium Low
1.00 – 2.00	Low

Table 4.8
Descriptive Analysis Mean and Standard Deviation for the Construct of Digital Skills Among PE Teachers in Selangor

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Communication and Collaboration	102	2	5	4.35	.568
Information on Data Literacy	102	3	5	4.32	.554
Teaching, Learning, and Assessment	102	1	5	3.91	.632
Creation of Digital Content	102	1	5	3.42	.766
Valid N (listwise)	102				

Table 4.8 shows the mean score and standard deviation for Research Question 2. Based on the table above, Communication and Collaboration obtained the highest mean score ($M=4.35$, $SD = .568$), followed by Information of Data Literacy ($M=4.32$, $SD= .554$). Two other components, Teaching, Learning, and Assessment ($M=3.91$, $SD=.632$) and Creation of Digital Content, obtained moderately high mean scores ($M=3.42$, $SD=.766$)

Table 4.9
Descriptive Analysis of Mean and Standard Deviation for Digital Skills Among PE Teachers in Selangor

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Digital Skills	102	3	5	4.00	.414
Valid N (listwise)	102				

Table 4.9 above shows the mean score and standard deviation of Digital Skills level among PE teachers in Selangor. Based on the table above, the level of Digital Skills is moderately high ($M=4.00$, $SD=.414$).

4.3.3 Research Question 3

Is there any significant difference in digital skills among PE teachers in urban and rural areas in Selangor?

The Independent Samples t-test analyzes the means of two independent groups to see if statistical evidence suggests that the related population means are significantly different. Table 4.10 presents the result of the independent sample t-test corresponding to Research Question 3.

Table 4.10
The result of The Independent Sample T-test

Group Statistics											
SCHOOL CATEGORY		N		Mean		Std. Deviation		Std. Error Mean			
DSM	URBAN	75		4.02		.416		.059			
	RURAL	27		3.99		.416		.057			
Independent Samples Test											
		Levene's Test for Equality of Variances				t-test for Equality of Means				95% Confidence Interval of the Difference	
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	Lower	Upper
						One - Sided p	Two - Sided p				
Digital Skills	Equal variances assumed	.044	.835	.376	100	.354	.707	.031	.082	-.133	.195
	Equal variances are not assumed			.376	99.352	.354	.707	.031	.082	-.133	.195

Independent sample T-tests were used to determine the significant difference in digital skills among PE teachers in urban and rural areas in Selangor. The test result showed that the value of $t(100) = .376$, $p = .707$ is insignificant. It indicates no significant difference exists between the mean score in digital skills among urban ($M=4.02$, $SD=.416$) and rural ($M=3.99$, $SD=.416$). In other words, PE teachers in rural and urban schools have similar levels of digital skills.

4.3.4 Research Question 4

Is there any difference in terms of digital skills between gender and age among PE teachers in Selangor?

The Two-Way ANOVA test compares the mean scores of two independent variables or two groups with two or more categories on one dependent variable. Thus, for RO 4, the TwoWay ANOVA was used to compare the differences between the differences in digital skills across ages and genders. The result of the Two-Way Anova test is shown below.

Table 4.11
The Result of the Two-Way Anova

Descriptive Statistics
Dependent Variable: DSM

AGE	GENDER	Mean	Std. Deviation	N
21-30 YEARS OLD	MALE	4.42	.509	3
	FEMALE	4.12	.274	28
	Total	4.17	.325	31
31-40 YEARS OLD	MALE	3.97	.406	8
	FEMALE	4.08	.390	29
	Total	4.02	.397	37
41-50 YEARS OLD	MALE	3.86	.559	5
	FEMALE	3.97	.372	23
	Total	3.93	.451	28
51 YEARS OLD AND ABOVE	MALE	3.70	.516	4
	FEMALE	4.21	.095	2
	Total	3.92	.457	6
Total	MALE	3.94	.486	20
	FEMALE	4.05	.346	82
	Total	4.00	.414	102

Levene's Test of Equality of Error Variances^{a,b}

		Levene Statistic	df1	df2	Sig.
DSM	Based on Mean	1.360	7	94	.232
	Based on Median	1.158	7	94	.334
	Based on the Median and with adjusted df	1.158	7	77.701	.336
	Based on trimmed mean	1.356	7	94	.233

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Dependent variable: DSM

b. Design: Intercept + AGE + GENDER + AGE * GENDER

Tests of Between-Subjects Effects

Dependent Variable: DSM

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Corrected Model	1.639a	7	.234	1.403	.213	.095	9.823	.567
Intercept	872.649	1	872.649	5230.321	<.001	.982	5230.321	1.000
AGE	1.004	3	.335	2.006	.118	.060	6.019	.501
GENDER	.149	1	.149	.892	.347	.009	.892	.154
AGE * GENDER	.682	3	.227	1.362	.259	.042	4.087	.352
Error	15.683	94	.167					
Total	1652.824	102						
Corrected Total	17.322	101						

a. R Squared = .095 (Adjusted R Squared = .027)

b. Computed using alpha = .05

Multiple Comparisons

Dependent Variable: DSM

Tukey HSD

(I) AGE	(J) AGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
21-30 YEARS OLD	31-40 YEARS OLD	.15	.116	.586	-.16	.45
	41-50 YEARS OLD	.24	.117	.179	-.07	.54
	51 YEARS OLD AND ABOVE	.25	.182	.529	-.23	.72
31-40 YEARS OLD	21-30 YEARS OLD	-.15	.116	.586	-.45	.16
	41-50 YEARS OLD	.09	.093	.759	-.15	.34
	51 YEARS OLD AND ABOVE	.10	.168	.934	-.34	.54

(I) AGE	(J) AGE	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
41-50 YEARS OLD	21-30 YEARS OLD	-.24	.117	.179	-.54	.07
	31-40 YEARS OLD	-.09	.093	.759	-.34	.15
	51 YEARS OLD AND ABOVE	.01	.168	1.000	-.43	.45
51 YEARS OLD AND ABOVE	21-30 YEARS OLD	-.25	.182	.529	-.72	.23
	31-40 YEARS OLD	-.10	.168	.934	-.54	.34
	41-50 YEARS OLD	-.01	.168	1.000	-.45	.43

Based on observed means.

The error term is Mean Square (Error) = .167.

A Two-Way ANOVA test was conducted to see if there was a significant difference between male and female PE teachers in Selangor aged 21-30, 31-40, 41-50, and 51 and above. This analysis also aims to see the effect of gender and age on the level of digital skills. Male and female teachers were further divided into four age groups, namely 21-30, 31-40, 41-50, and 51 and above. A post hoc comparison using the Tukey test shows that the mean score of the digital skills level among PE teachers in Selangor does not show a significant difference in terms of ages 21-30 ($M = 4.17$, $SD = .325$), 31-40 ($M = 4.02$, $SD = .397$), 41-50 ($M = 3.93$, $SD = .451$), and 51 and above ($M = 3.92$, $SD = .457$). The main effect of gender $F(1,94) = .892$, $p = .347$, and the interaction effect of age $F(3,94) = 1.362$, $p = .259$ are not significant. It can be concluded that there is no difference in the level of digital skills among male and female PE teachers of different ages in Selangor.

4.3.5 Research Question 5

Is there any difference in terms of digital skills construct between rural and urban areas among PE teachers in Selangor?

The multivariate analysis of variance (MANOVA) is used when you have two or more dependent variables or one independent variable with two or three categories. The purpose of MANOVA analysis is to compare groups of categories and explain to us whether or not there is a significant mean difference between the groups of categories

on the combination of dependent variables. Thus, below is the result of MANOVA based on the research question:

Table 4.12
The Result of the MANOVA

Residuals Statistics^a

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	1.34	1.71	1.57	.075	102
Std. Predicted Value	-3.031	1.948	.000	1.000	102
Standard Error of Predicted Value	.060	.288	.105	.035	102
Adjusted Predicted Value	1.22	1.83	1.57	.086	102
Residual	-.699	.543	.000	.492	102
Std. Residual	-1.393	1.082	.000	.980	102
Stud. Residual	-1.472	1.265	.001	1.006	102
Deleted Residual	-.825	.776	.001	.519	102
Stud. Deleted Residual	-1.481	1.269	.000	1.007	102
Mahal. Distance	.428	17.045	3.961	4.144	102
Cook's Distance	.002	.158	.011	.019	102
Centered Leverage Value	.004	.320	.039	.041	102

a. Dependent Variable: GENDER

Descriptive Statistics

SCHOOL CATEGORY		Mean	Std. Deviation	N
TLA	URBAN	3.94	.584	75
	RURAL	3.88	.678	27
	Total	3.91	.632	102
CDC	URBAN	3.52	.667	75
	RURAL	3.32	.842	27
	Total	3.42	.766	102
IDL	URBAN	4.28	.560	75
	RURAL	4.36	.552	27
	Total	4.32	.554	102
CC	URBAN	4.33	.471	75
	RURAL	4.37	.649	27
	Total	4.35	.568	102

Box's Test of Equality of Covariance Matrices^a

Box's M	23.654
F	2.263
df1	10
df2	47125.235
Sig.	.012

Tests the null hypothesis that the observed covariance matrices of the dependent variables are equal across groups.

a. Design: Intercept + CATEGORY

Multivariate Tests^a

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Observed Parameter Power ^c
Intercept	Pillai's Trace	.993	3699.104 ^b	4.000	97.000	<.001	.993	14796.417 1.000
	Wilks' Lambda	.007	3699.104 ^b	4.000	97.000	<.001	.993	14796.417 1.000
	Hotelling's Trace	152.540	3699.104 ^b	4.000	97.000	<.001	.993	14796.417 1.000
	Roy's Largest Root	152.540	3699.104 ^b	4.000	97.000	<.001	.993	14796.417 1.000
Category	Pillai's Trace	.046	1.174 ^b	4.000	97.000	.327	.046	4.696 .356
	Wilks' Lambda	.954	1.174 ^b	4.000	97.000	.327	.046	4.696 .356
	Hotelling's Trace	.048	1.174 ^b	4.000	97.000	.327	.046	4.696 .356
	Roy's Largest Root	.048	1.174 ^b	4.000	97.000	.327	.046	4.696 .356

a. Design: Intercept + CATEGORY

b. Exact statistic

c. Computed using alpha = .05

Levene's Test of Equality of Error Variances^a

		Levene Statistic	df1	df2	Sig.
TLA	Based on Mean	.000	1	100	.997
	Based on Median	.000	1	100	.997
	Based on the Median and with adjusted df	.000	1	91.392	.997
	Based on trimmed mean	.000	1	100	.986
CDC	Based on Mean	1.971	1	100	.163
	Based on Median	2.111	1	100	.149
	Based on the Median and with adjusted df	2.111	1	97.778	.149
	Based on trimmed mean	1.938	1	100	.167

		Levene Statistic	df1	df2	Sig.
IDL	Based on Mean	.113	1	100	.737
	Based on Median	.082	1	100	.776
	Based on the Median and with adjusted df	.082	1	99.565	.776
	Based on trimmed mean	.079	1	100	.779
CC	Based on Mean	7.325	1	100	.126
	Based on Median	2.863	1	100	.094
	Based on the Median and with adjusted df	2.863	1	99.184	.094
	Based on the trimmed mean	6.738	1	100	.011

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + CATEGORY

School Category

Dependent Variable	SCHOOL CATEGORY	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
TLA	URBAN	3.942	.091	3.762	4.122
	RURAL	3.884	.087	3.711	4.057
CDC	URBAN	3.524	.109	3.308	3.740
	RURAL	3.321	.105	3.113	3.529
IDL	URBAN	4.276	.079	4.118	4.433
	RURAL	4.363	.076	4.212	4.515
CC	URBAN	4.333	.082	4.172	4.495
	RURAL	4.371	.078	4.215	4.527

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Observed Parameter Power ^e
Corrected Model	TLA	.087 ^a	1	.087	.217	.643	.002	.217
	CDC	1.050 ^b	1	1.050	1.803	.182	.018	1.803
	IDL	.196 ^c	1	.196	.635	.428	.006	.635
	CC	.036 ^d	1	.036	.111	.739	.001	.111
Intercept	TLA	1559.308	1	1559.308	3870.661	<.001	.975	3870.661
	CDC	1192.788	1	1192.788	2048.977	<.001	.953	2048.977
	IDL	1900.073	1	1900.073	6158.798	<.001	.984	6158.798
	CC	1929.078	1	1929.078	5919.015	<.001	.983	5919.015
Category	TLA	.087	1	.087	.217	.643	.002	.217
	CDC	1.050	1	1.050	1.803	.182	.018	1.803

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Observed Parameter Power ^e
	IDL	.196	1	.196	.635	.428	.006	.635
	CC	.036	1	.036	.111	.739	.001	.111
Error	TLA	40.285	100	.403				
	CDC	58.214	100	.582				
	IDL	30.851	100	.309				
	CC	32.591	100	.326				
Total	TLA	1601.167	102					
	CDC	1251.111	102					
	IDL	1935.563	102					
	CC	1965.333	102					
Corrected Total	TLA	40.373	101					
	CDC	59.264	101					
	IDL	31.047	101					
	CC	32.627	101					

a. R Squared = .002 (Adjusted R Squared = -.008)

b. R Squared = .018 (Adjusted R Squared = .008)

c. R Squared = .006 (Adjusted R Squared = -.004)

d. R Squared = .001 (Adjusted R Squared = -.009)

e. Computed using alpha = .05

A MANOVA analysis was conducted to determine whether there were significant differences in teaching, learning and assessment, creation of digital content, information data literacy, and communication and collaboration among PE teachers in urban and rural areas of Selangor. The independent variable is categorical. Data exploration tests were conducted to check normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity with no serious violations.

The results of the analysis show that there is no significant difference between rural and urban for the entire dependent variable, $F(4,97) = 1.174$, *Wilk's Lambda* = .954; partial eta squared = .046.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

This study developed an instrument with high validity and reliability to assess digital skills among PE teachers in Selangor. In addition, it examined the level of digital skills among the samples based on category, age, and gender in the Selangor area. All findings and analyses will be discussed and presented in later subchapters. Furthermore, the impacts of this research are discussed accordingly based on theoretical, methodological, practical, and recommendations for future research.

RQ1 What is the construct validity evidence of digital skills questionnaires among PE teachers in Selangor?

There are several commonly used instruments for assessing teachers' digital skills. Given its advantages, particularly in meeting future expectations, the use of technology in the educational system is unavoidable in today's environment. It is acknowledged that teachers and students should be prepared to meet the demands of a rapidly advancing, technology-driven world. At the same time, there is a call to empower teachers to make data-driven decisions and increase global competitiveness. There are, by nature, plenty of digital competence instruments for educators that aim to evaluate one's levels of competence to guide programming and policy for more effective professional development, alignment of digital competencies and educational policy, equitable access to digital tools, and nuanced digital tools that can be used most effectively in teaching and learning.

Researchers in Malaysia have developed several instruments to measure teachers' digital skills. However, to the best of the researcher's knowledge, none are specifically focused on PE teachers. Hence, this study was conducted to fill the gap of past research. For example, Baharuddin et al. (2021) examined the technical, cognitive, and social-emotional constructs by using 6 items for each construct. However, the study did not use PE teachers as the sample, but teachers from other subjects. The study also focused on the validity and reliability of the instrument. This has raised the question of

whether the findings are generalizable for PE teachers. Concerning the panel of experts' experience, they are likely to have less than 10 years of experience, and as argued in Grant & Davis (1997), experts should be content specialists with 10 years of field experience. In this light, a long experience translates to a thorough understanding of the study's goals and familiarity with the procedures.

Dorasamy & Abu Samah (2022) developed an instrument to measure the digital literacy in media use among Tamil Language teachers. The instrument focused on 3 constructs —knowledge, skills, and attitudes toward digital skills —with 5 items for each construct. Suzlina & Jamaludin, (2016) highlighted the constructs of knowledge, skills, attitudes, and challenges. 8 items were used to measure knowledge, 11 items for skills, and 10 items each for attitude and challenges. It can be deduced that there is still no specific instrument developed to identify the level of their digital skills among PE teachers in Malaysia. Most instruments also do not use a comprehensive construct as this instrument does.

Several studies have explored teachers' digital competence across Malaysian states. Abu Hanifah et al. (2023) researched secondary school teachers' technology self-efficacy, attitudes, and digital competence in Pahang, however, no quantitative data was presented to determine actual levels of competence. They found levels of awareness and positive attitude toward technology usage, but minimal evidence of digital pedagogy in practice. Yet, compared to the study at hand, Selangor PE teachers found themselves with digital competence from moderate to high levels across the six domains, suggesting a better field of study and more streamlined, assessment-based implementations for using technology - possibly due to higher connectivity in the area.

In this vein, Ahmad and Rathakrishnan (2023) indicate that most teachers in Kedah have an adequate level of digital literacy suggesting high preparedness. Yet theirs was a general teaching study whereas this study indicates that the technology use exists already at the teacher level for the PE movement based environment . In addition, PE teachers in Selangor are digitally literate and can create and collaborate digitally and employ data-based assessment - findings not previously reported.Omar and Mohmad (2023) also noted high ICT integration and online readiness among Klang Valley teachers, yet their study did not differentiate by subject.

Such findings are consistent with this generic understanding where Selangor PE teachers possess a high level of digitalized behavior, but in more contextual,

practical applications like gamified learning, performance evaluation, and digital grading.

For instance, Anuar et al. (2019) assessed ICT readiness through qualitative measures only and Irwahand et al. (2022) studied PE teachers only from varying backgrounds with varying competencies but the present study summarizes findings clearer, placing the majority of PE teachers in the moderate to high range with a definite distinction in infrastructure established in Selangor - 63.7% of fixed broadband connectivity throughout the state as opposed to over 99% 4G and 5G accessibility - infers that online platforms and opportunities for professional development were accessible.

Ultimately, where prior studies found an overwhelming majority trend within teacher digital literacy, the present study gives a clearer, more qualitative, data-informed approach within a specific domain. Selangor PE teachers maintain their digital literacy in the high range with access to excessive infrastructure based resources, appropriately catered professional development and applicable implementation within the classroom. Therefore, the present study finds that Selangor serves as a gold standard among Malaysia's PE teacher digital literacy and supports the need for infrastructure readiness for competent and technology effective teaching in this area.

As previously mentioned, The DigCompEdu was a product of a European Union framework DigComp, with 6 areas of focus - professional engagement (PE), digital resources (DR), teaching and learning (TL), assessment (A), empowering learners (EL), facilitating learners' digital competence (FLC) - and subsequently adapted by many countries. For example, Rojo-Ramos et al. (2020) created a measuring instrument to investigate information and data literacy, communication and collaboration, digital content creation, digital security and problem-solving in relation to teachers in Spain. Construct definitions were derived from DigCompEDU, as this study will do to stay consistent. This measuring instrument was published through the General Secretary of Education and sought to investigate similar notions of digital competence in regards to professional engagement, digital content creation, teaching and learning and assessment.

Another significant instrument is the International Society for Technology in Education (ISTE). The ISTE boasts 7 constructs for evaluation, facilitation, designation, collaboration, leadership, citizenship and learning (Crompton, 2023) - thus a more comprehensive approach to teacher technology integration in teaching and student

digital literacy. The ISTE boasts a comprehensive digital competencies framework for educators and is used for self-reflection, professional development and program evaluation. In addition, instruments and tools based on the ISTE standards have been developed to assess teacher digital competencies relative to the ISTE standards to assess teachers' awareness of their strengths and weaknesses regarding technology implementation in the classroom.

Another relevant framework is TPACK (Technological Pedagogical Content Knowledge), one of the more widely known frameworks for assessing teachers' levels of technology integration for instruction and learning. TPACK is an intersection of three areas of knowledge where Teacher Expertise is supported, assessed, and developed. Content Knowledge (CK) is the assessment of knowledge on a topic - informational and conceptual. One must know their material on the surface and the deep structure, which means educators are no exception. Pedagogical Knowledge (PK) is the assessment of awareness of methods; educators must be cognizant of levels of engagement, growth assessment for feedback, nuanced communication to learn about each student, and awareness of effective, democratic learning environments that render them experts. Technological Knowledge (TK) is the assessment of resources and systems through which educators may implement methods for improved instruction for learning. This means teachers must be assessed as to whether they possess sufficient awareness of digital resources to implement them in intricate supportive lessons.

As evidenced by the findings, most current instruments cover three domains: knowledge, skills and attitudes (Baharuddin et al., 2021; Dorasamy & Abu Samah, 2022; Suzlina & Jamaludin, 2016). Furthermore, such inclusiveness should be built upon in future research to suggest what should be emphasized for PE teachers. However, Rojo-Ramos et al. (2020) focused on these five: information and data literacy, communication and collaboration, creation of digital content, digital security and problem solving. Therefore, the constructs that emerged from the CFA findings of this study were information and data literacy, communication and collaboration, creation of digital content and teaching, learning and assessment.

The difference shows that the latter four constructs are applicable to Malaysian PE teachers.

1. Information and digital literacy necessary for PE teachers to implement digital tools for teaching and learning is information literacy of information. Information becomes a more significant part of the physical health awareness equation - from sports smart watches and fitness wristbands/devices to the applications or portals that allow students access to their performance data (what they've done so far, what other class requirements are ,etc.). Thus, PE teachers will need the literacies which compile and assess student information for performance, health and information. The more information literacy, the more the teacher will be informed in championing effective lessons versus student needs/capabilities. For example, if a teacher sees how many steps a watch records, he/she can discern the student's place within the curriculum to engage better in new challenges - or even warn the student against new challenges. In addition, information literacy gives PE teachers awareness of the ethics behind approaching such applications so that student privacy is respected and their data won't be in jeopardy for unethical purposes. Thus, the more information literacy PE teachers receive, the more effective their digital tool teaching will become to render a differentiated learning experience of which the teacher will have a better understanding due to the relationship between the academic lesson and health.
2. Communication and collaboration are essential for PE teachers when implementing digital teaching in learning. Digital tools enable PE teachers to communicate more effectively with students, parents, and colleagues. Through online platforms, teachers can provide instructional videos, assignments, and feedback, fostering continuous learning beyond the classroom. Collaboration with fellow teachers allows PE teachers to share resources, strategies, and insights on integrating technology into lessons, enhancing professional development. Moreover, communication helps create a supportive learning environment where students feel comfortable discussing their progress, challenges, and goals related to physical fitness. Collaborative efforts also extend to using digital tools for group activities and teamwork, where students can engage in virtual fitness challenges or share progress through apps and platforms. This encourages peer learning and builds a sense of community, both of which are essential for creating an inclusive and interactive digital PE

classroom. Ultimately, strong communication and collaboration improve the overall teaching and learning experience.

3. Digital teaching and learning would require greater communication and collaboration between PE Teacher and PE Students/Peers. Digital communications will facilitate PE Teacher and PE Student/Peer more efficiently - video digital communications from teacher to student on success or achievement, digital resources - from teacher videos in class to recorded PE assessments in the classroom - the teacher can note achievements from the outside world. In addition, it's easier for the other subject's teachers to collaborate in this situation as all resources required and proper practices in a history/math/English classroom can be implemented the same way in PE. This would be a professional development digital teaching and learning for the other educators, as well, who don't even teach PE. In addition, a lot of digital communication will occur to reinforce learning in the classroom as a more specific learning area can allow children to be more comfortable to open up about more intimate accomplishments in the realm of understanding how to be an effective physical being. Finally, digital teaching and learning requires PE Students/Peers to collaborate - video calls or Google chats get people working together for team sports without needing the same room; educators can get kids to keep each other accountable texting in small groups about accomplishments or creating a digital board game with elements requiring teamwork and submission requests. Extensive communication and collaboration mean so much for student learning but even more easily facilitated learning.
4. Teaching, learning and assessment support PE teachers digital technologies because it promotes expectations of digital engagement virtual and physical that makes teaching in-person and assessment more effective within the school year. For example, a PE teacher could digitize a teaching component via video demonstration exercise or a web exercise/course or gamification app-based elements to enhance the game-like components of PE, thereby reducing the need to teach components IRL. Learning supports digital technologies because students can learn independently. For example, if a student is out of class and misses the teaching of a particular digital video, they can learn on their own speed of a digital video or a digital discussion to ensure they are caught up instead of falling behind without any supplemental resources. This allows for

differentiated learning. Finally, assessment supports digital technologies because it gives PE teachers more analytical data regarding student use and engagement patterns both in-class and out of class. If PE teachers expect students to achieve their fitness goals at home or virtually PE styled, they should also have digital access to this wearable/app/tracked information as part of a comprehensive assessment for change.

There are numerous reasons that physical education differs from all the other subjects. For example, it is a subject based on physical activity, health and wellness. In other words, math, geography, history are all subjects that rely upon cognitive developmental skills but PE relies upon muscular development, athleticism, motor skills and health with an applicable area beyond the classroom. In addition, unlike other subjects that rely upon much more collaborative measures and written/conceptual achievements to pass, PE is something that requires one's body to get up - exercise and sports are the main components here - meaning, one can fail PE without ever getting off of their behind, just like one can fail math or history without memorizing textbook pages or writing essays. One can also go to college to retake math and English courses - one does not have to do PE again if one merely needs to pass to get off of his or her chair to become active. In addition, PE encourages wellness in other realms beyond physical. While other subjects attempt to incorporate mental health, PE encourages stress relief through enjoyable physical activity in addition to a challenge to increase one's performance which can encourage a boost in self-esteem. This can happen through one's performance in one sport but also encouraged performance across many sports or group workouts assessed by peers for extra credit outside the classroom. Social skills are more important in PE - inclusion via teamwork and participation in games and group projects requires communication and group dynamics that are unique to PE.

The findings of this study for digital literacy of physical education teachers will pave the way for new and innovative research within the field as these measures were crafted to take specifically for Malaysian physical education teachers. Within this study, validity and reliability can be determined. This is supported by the assessment of digital literacy levels of Malaysian physical education teachers especially because Teaching and learning, Digital content creation, Communication and collaboration, and

Information and data literacy are essential to ensure physical education teachers are abreast of technology instruction and learning.

RQ2 What is the level of digital skills among PE teachers in Selangor?

The study found that the level of digital skills among PE teachers in Selangor is medium-high. This finding aligns with previous studies like Jia Rou et al. (2022) and Tai et al. (2022). Teachers' high level of digital skills is attributed to factors such as the COVID-19 pandemic (Sari, 2024; Winter et al., 2021). During the pandemic, teachers had to switch from predominantly face-to-face interactions to online teaching during school closures (Jumareng et al., 2021). Academic subjects, including PE was taught online (Kim et al., 2021). Teachers were forced to learn and use It devices to continue teaching their students (Tang & Chaw, 2016). This has indirectly encouraged teachers, including PE teachers, to improve their digital skills competence further (Fahmi et al., 2024; Roslan, 2024) for teaching, learning management, and school administrative works.

In line with the emphasis on online teaching and learning and the impact of COVID-19, in 2020, the government launched the Digital Educational Learning Initiative Malaysia (DELIMA) as one of the platforms to ensure the smooth running of school administration, including the management of extracurricular activities. Activities According to the findings (Hafiza Hamzah et al., 2021), Hulu Langat district principals demonstrated visionary leadership, a digital-age learning culture, excellence in professional practice, systemic improvement, and digital citizenship. They can't wait to become their school's digital leaders. Teachers, including PE teachers, have been indirectly pushed to use ICT in their work by the school administration's readiness and role in its use. Additionally, teachers working under alternate administrators are now better equipped to acquire more advanced digital abilities. The emphasis on the use of ICT in the learning process actually began in 2013 when it was highlighted as one of the core components of the Malaysia Education Blueprint 2013-2025. One of the components of the Malaysia Education Blueprint is to leverage ICT to scale up quality learning across Malaysia. In the blueprint, the MOE stated its aspiration to improve internet connectivity and virtual learning, enhance online information to promote excellent practices, begin by creating a video collection of top teachers delivering

classes, and utilize ICT for distance and self-paced learning to provide high-quality instruction regardless of location or student ability level.

Teacher digital competence has also risen through governmental efforts. According to the Malaysia Education Blueprint 2013-2025, the Malaysian government aims to facilitate ICT in education and train educators to assess 21st-century learning needs. For example, 1BestariNet provides national internet access to all schools for standardized digital learning opportunities; this overcomes the digital divide as even rural schools possess the same equity as urban ones. In addition, teachers are encouraged to acquire digital competency certifications online through the Lifelong Learning Program. Yet, simultaneously, programs like Microsoft's Partners in Learning provide free online resources and training that encourage ICT literacy enhancement. Junus et al. (2021) report that teacher digital literacy is significantly higher when teachers engage in self-directed learning. In the context of PE, teachers demonstrate moderately high ICT use, reflecting both structured exposure to technology and the Ministry of Education's support. This level, however, can still be enhanced, and the diverse components of PE teachers' digital skills can be systematically assessed.

There are four main components: Communication and Collaboration (CC), Information and Data Literacy (IDL), Teaching, Learning, and Assessment (TLA), and Creation of Digital Content (CDC). The CC and IDL are components where PE teachers in Selangor excel. The ability to communicate and collaborate using ICT for teaching and learning to students due to exposure to ICT facilities provided by the government, such as the DELIMA platform, Microsoft's Partners in Learning, Google Classroom, Zoom, and Frog VLE, has given teachers exposure to the best ways and platforms to communicate and collaborate in the online teaching and learning process. In terms of IDL, the findings of this study are in line with previous studies (Fazli Baharuddin et al., 2023; Junus et al., 2021; Ramli & Mohamad Arsad, 2023) that found teachers to have high abilities and confidence in their ability to evaluate information and data literacy towards the use of ICT in the teaching and learning process. The facilities provided also indirectly offer opportunities for PE teachers to explore the ICT facilities they can use in their learning and to increase their data literacy with ICT. Digital applications provided by both government and private platforms greatly help teachers improve their digital skills in planning, building, collaborating, communicating, and managing online learning. This free facility indirectly enhances teachers' skills in communicating and

collaborating with students in teaching and learning, as well as their data literacy in ICT (Haleem et al., 2022).

The components of TFA and CDC were medium-high due to the nature of the PE subject itself. The PE subject consists of 3 domains: psychomotor, cognitive, and affective. The best method for PE subjects was face-to-face (Ozkara & Kalkavan, 2021) as PE teachers have an essential role in advocating for lifelong fitness, championing mental well-being, engaging communities and the environment, and improving cognitive and mental development (Ghani et al., 2015; Rahman et al., 2021). Kim et al. (2021) and Chu et al. (2022) indicate that PE subjects include demonstrations, presentations, grouping, and movements; therefore, advanced equipment or apps are necessary for PE teachers to support the PE learning process (Mokmin & Ridzuan, 2022). However, the need for immersive equipment such as projectors, digital cameras, or virtual reality apps, which are most likely not provided by schools or the government, makes PE teachers less interested in being involved in the Creation of Digital Content.

Furthermore, to ensure the development of the 3 domains, the use of equipment with more advanced technology is required (Gallagher, 2020; Mohnsen, 2012), and most teachers only have limited equipment and have a moderate level of digital skills, whereas to ensure that PE subjects achieve their goals, the level of digital skills of PE teachers must be at the level advance to enable them to use more sophisticated apps in producing suitable digital content.

This statement is also supported by previous studies (Mohd Nor Azmi & Mohd Hamzah, 2023; Sari, 2024), which stated that among the constraints in applying technology in the teaching and learning process is the lack of appropriate software resources and the quality of equipment that does not meet the specifications of the use of more advanced technology. In addition, teachers' digital skills remain at a basic level, which indirectly hinders their ability to create digital content or animations compatible with their teaching methods (Moses & Wong, 2022; Radin & Yasin, 2018; Sari, 2024).

According to Kretschmann (2015), the government's emphasis on mainstream subjects such as mathematics and science, which are important in exams, has led PE to be seen as a minor subject. This is evident in the Malaysian Education Blueprint, which emphasises the use of technology in science and mathematics (Malaysian Education Blueprint 2013-2025). Indirectly, it explains why these two components remained at a moderately high level, while they can be further improved in the future.

In the 21st century, teachers are expected to shift instructional practices from teacher-centred to student-centered approaches (Anuar et al., 2019). Students often prioritize interactive learning experiences facilitated by ICT tools such as social and video communication applications, as well as flexible learning opportunities. To meet these expectations, they must proactively enhance their ICT skills (Chama, 2023). Previous research has identified barriers to ICT integration in teaching and learning processes, including a lack of competency, motivation, and access to ICT tools, as well as inadequate equipment and institutional regulations (Gutiérrez-Martín & Tyner, 2012). This obstacle hinders the learning and teaching of technology, especially for PE teachers, because the PE subject prioritises the development of 3 domains: psychomotor, cognitive, and affective. Furthermore, the PE curriculum differs from basic knowledge-based disciplines since it focuses on motor skills that require practice and movement, and PE classes are the essential contexts in which they experience physical activity and motor movements. (Ekberg, 2021; Ramer et al., 2021; Vasileva et al., 2024). In this regard, the lack of digital skills among PE teachers will further hinder the integration of technology in PE education, given the distinct aspects that PE teachers need to adopt.

RQ3 Is there any significant difference in digital skills among PE teachers in urban and rural areas in Selangor?

RQ4 Is there any difference in terms of digital skills between gender and age among PE teachers in Selangor?

RQ5 Is there any difference in terms of the digital skills construct between rural and urban areas among PE teachers in Selangor?

One of the main focuses of this study is to determine whether there is a significant difference in digital skills among PE teachers in urban and rural areas. This study found no significant difference in the digital skills scores between PE teachers in rural and urban areas.

This suggests that teachers' teaching location — rural or urban — does not affect their digital proficiency. Similarly, Wang (2020) found that teacher attitudes and competence did not differ between locations. In this regard, urban teachers

demonstrated advanced skills beyond the "familiarity and confidence" stage, and are looking for novel approaches to adapt technology. Meanwhile, rural teachers were able to comprehend the technological integration process, but they fell short of the "familiarity and confidence level." The differences in technology integration could be link to the level of technology availability.

A survey by Lin et al. (2023) shows that urban and rural respondents' technology acceptance attitude and the expectations of government provisioned foundations were moderately positive. Therefore, technology acquisition and use, awareness and access of technology and benefits of ICT, and foundations, means, and incentives should be improved .

As noted, digital literacy is less found between urban teachers and rural teachers, probably because of comfortable access to the internet, provisioned software or tools, expertise, and the need to have technological utilization skills mastered (Devisakti et al., 2024; Elaish et al., 2019; Ina Murni Hashim, 2024; Kim How et al., 2022; Sia et al., 2023).

In response to research acknowledging poor internet access and technology centers as barriers to online teaching and learning, many government initiatives have been developed in this area. For example, the Malaysia Education Blueprint 2013-2025 indicates the MOE's plans for digital access and a virtual learning environment through 1BestariNet for all 10,000 schools. The same goes for the Selangor state government, which has invested RM1.6 million in 2020 and RM2 million in 2021 to maintain its Smart Selangor WiFi service. In 2023, the MOE Budget revealed that the government intends to spend approximately RM 725 million to expand upgrade efforts and digital access nationwide, indicating such technological and digital resource access is not limited to only rural or urban areas, but all schools. Furthermore, such an effort needs to be made nationwide for PE educators to utilize digital literacy improvements as a comparable developmental initiative for comparable skill integration during teaching and learning. This was similarly proposed in the 2023 budget when the government announced that 50,000 laptops would be distributed to all MOE schools and institutions for digitized learning.

Furthermore, the MOE ICT Transformation Plan (2019-2023) intends for the Internet Service Providers to improve school internet access and improve the Area Network Local (LAN) for schools from the computer lab into the school networked facilities networked and wireless (Nordin et al., 2023). Such infrastructure

improvements and network access facilitate using the facilities for teachers and ease the online teaching challenges. Therefore, according to Technology Continuance Theory (TCT), in this case, expectations of enhanced digital competencies based on user satisfaction and intention to continue utilizing ICT for teaching and learning increases. For TCT, confirmation of expectation - perceived usefulness and perceived ease of use - applies to teacher satisfaction. As per the latest Digital Education Policy (2023), as other confirmations of expectations, the National Digital Network (Jendela) intends to increase ICT use and levels of internet accessibility and digital learning management facilities. In reality, this has expanded connectivity and universal access to internet options across rural and urban teachers who can now boast similar abilities as their urban counterparts. Therefore, in this case, teacher satisfaction can impact their intention of continued digital developments.

Digital skills for teaching and learning in the new digital age are ineffective without internet access or proper infrastructure. (Ina Murni Hashim, 2024; Md Hashim et al., 2024; Nordin et al., 2023). Civil Servants' digital skills and acceptance are perceived positively as long as they are digitally literate and required to take courses/training. A Digital Literacy policy has been implemented by the government and targeted at civil servants. Given that teachers are civil servants, this occurs with efforts on teacher motivation to enhance their digital skills. Additionally, the MOE employs a Digital Jauhari Teacher programme, a course for teachers and certification. Also, the MOE has allocated RM1 million to ensure that courses on AI technology empowerment for teachers are available. Thus, the MOE recognition provides indirect motivation for teachers to expand their digital skills and promote digitisation.

The SDT highlights 3 psychological needs - autonomy, competence, and relatedness (Deci & Ryan, 2008) - that create internally driven motives to learn and apply digital teaching methods. Educators are thus driven to choose appropriate technological teaching applications, use such applications for student development in a pedagogically meaningful and ethically viable fashion, and engage with peers in a process of digital literacy when autonomy, competence and relatedness needs are addressed (Chiu, 2022; Salikhova et al., 2020 Sørenbø et al., 2009).

Therefore, the national push for digitization of teacher literacy is a welcomed opportunity as it leads to autonomy, support competence and fulfills the need for relatedness since funding for upskilling courses is available (Chiu et al., 2024). For instance, the MOE in collaboration with Apple Professional Learning Specialist

Malaysia plans to upskill approximately 100000 teachers, Apple Teachers and MOE Digital Jauhari Teachers. Such efforts are compounded through the MOE's intention to equalize rural and urban access to digital learning platforms.

In addressing research question 4 on differences in digital skills among teachers of different genders and age groups, the findings once again show no difference in digital skills levels among PE teachers across genders and age groups in Selangor. This indicates that, contrary to other research suggesting these factors affect the development of digital abilities, the level of digital proficiency among Selangor's physical education teachers is not influenced by age or gender. Rojo-Ramos et al. (2020) found that teachers' educational level, age, gender, educational experience, and computer use could impact their adoption of innovative teaching practices. In contrast, as noted by Sutton (2011), older teachers who have not been exposed to technology in teaching and learning have difficulty using it while those who were exposed to it early on have no issue. The results of this study, however, indicate that there is no difference due to factors such as government policy on training and courses, and the role of teacher education institutions in preparing aspiring educators for the digital age of education.

Teacher digital competence also varies by state in Malaysia. For example, Abu Hanifah et al. (2023) evaluated technology self-efficacy, attitudes and digital competence of secondary teachers in Pahang that did not use quantitative analysis to determine actual levels of ability, findings reported levels of awareness and technology attitudes and digital competence but not digital pedagogical use. Yet this study found PE teachers to have digital competence at a moderate to high level for all six constructs, as determined by confirmatory factor analysis - information and data literacy; communication and collaboration; digital content creation; problem-solving; security; teaching and learning. Thus, this difference may also be due to a more advanced digital landscape of Selangor versus the rest of the country and more intensely focused research within a content area.

Similarly, Ahmad and Rathakrishnan (2023) revealed that 90.4% of teachers in Kedah have sufficient digital literacy and integration, suggesting that digital competencies are sufficiently spread across the region. However, their findings apply to teaching and learning in general and do not assess the PE-specific, contextual details. Therefore, this study is an extension of theirs since Selangor PE educators demonstrate similarly high degrees of digital engagement but in a more context-specific, movement-oriented learning environment. Selangor PE educators' digital competencies fell

between moderate and high, indicating enough accessibility and understanding for practical application and comprehension as well as content development, technological collaborative opportunities and technology and data analytics assessment for further exploration and evaluation which was not assessed in the Kedah study.

Omar and Mohmad (2023) reported high mean scores (3.97, 3.86, and 3.80) for digital pedagogy, ICT integration, and online readiness among secondary teachers in Klang Valley, suggesting high technological engagement in teaching. While the geographic proximity and infrastructure conditions of the Klang Valley are similar to those of Selangor, their study did not differentiate between subject domains. The current research refines this understanding by focusing on PE teachers and demonstrating similarly high levels of digital competence, yet with an emphasis on applied, context-driven skill sets. This indicates that PE teachers in Selangor have effectively leveraged the state's digital advantages to implement interactive teaching practices such as gamified learning, video-based performance analysis, and digital assessment, which are absent in Omar and Mohmad's general findings.

While Anuar et al. (2019) compared ICT literacy, pedagogy, and online preparedness amongst government secondary school teachers across Peninsular Malaysia, they did not qualitatively measure degrees of competency. Thus, their qualitative observations reveal that implementation is sporadic and ICT capacity is low for these teachers. On the other, the current study quantitatively assessed digital competency of the Selangor PE teachers and a similarly aligned consistent moderate to high level across the six constructs has been reported. Thus, Selangor teachers possess more than awareness and functional abilities and pedagogical functionalities to digital opportunities in their classrooms which means that there are measurable, actionable results that were not substantiated by Anuar et al.'s findings.

Irwahand et al. (2022), the only prior study to focus directly on PE teachers, reported that 39% of teachers demonstrated excellent competence, 37% moderate competence, and 24% poor competence, indicating a diverse range of digital capabilities. However, their study emphasized general ICT integration rather than multidimensional digital competence. The current research refines this framework by adopting a holistic, validated model and finding that PE teachers in Selangor predominantly fall within the moderate to high competence range, with very few displaying low proficiency. This improvement can be linked to Selangor's advanced digital infrastructure, including 63.7% fixed broadband penetration and near-universal

4G and 5G coverage, which enhances access to online professional development and cloud-based instructional tools. Consequently, Selangor's PE teachers demonstrate a more consistent and applied form of digital competence compared to the broader national distribution observed by Irwahand et al.

In summary, while prior studies showed varying degrees of teacher digital competence ranging from satisfactory to high across Malaysian states - this study boasts a generalizable, subject-specific, data-driven approach to PE teacher digital competence in Selangor - in addition, these findings corroborate the relatively medium to high levels of competency among PE teachers in Selangor compared to other studies - because of situational factors. This means that professional development, attributing to digital inclusion and digital application in Selangor's schools, lead to higher digital competency than other states. Thus, Selangor can be the new benchmark for PE teachers' digital competency in Malaysia and for subsequent studies and policy implementation.

This study also showed that Selangor is the most expansive digital connectivity ecosystem relative to the other states. Fixed broadband coverage is higher in Selangor (63.7%) compared to Kelantan (25.1%) and exceeds the national average (48.7%) with household and personal reach nearly ubiquitous level. Mobile broadband access is similarly comprehensive with 4G (99.87% of populated areas) and 5G (96.1% of populated areas) with strong infrastructure supporting such connectivity. Such advantageous infrastructure means that Selangor PE teachers have more online resources to learn from, cloud-centered teaching applications, and more real-time, digital professional development offerings. In contrast, PE teachers in the less connected regions - namely Kelantan and parts of Sarawak - experience slower connections, inconsistent access and less exposure to online teaching resources and the like, which may explain the differences observed in the digital-skills scoring of the PE teachers.

These findings are in line with prior research that indicates infrastructural readiness is a major predictor of teacher digital competence and engagement with technology-embedded instruction (Ghavifekr & Rosdy, 2015; Hämäläinen et al., 2021). Therefore, the equity of connectivity should be addressed as a fundamental aspect of the digital-skills generating process, not merely as a situational factor. For Selangor PE teachers, this access and infrastructure mean more equity of technology embedded instruction, increased confidence in digitally embedded lesson applications, and more

opportunities for interactivity and analytics. Ultimately, the current research applies a theoretical contribution to discipline-based digital competence while also positing professional development and policy mediation for teacher reskilling efforts aimed at localized technological facilitation and national digitalization transformation.

As noted by Nordin et al. (2023), training in digitisation can help teachers master digital technology applications and devices. Thus, the government focuses on courses and training to equip teachers with the digital skills needed to address the challenges of digitisation in education. For example, MOE partnered with Microsoft in Education to provide educators with training and courses on using Microsoft applications for teaching and learning. The MOE has also launched several initiatives, such as the Technology Empowerment Course, the Apple Teacher Course, and the Digital Professional Certificate, to support online teaching and learning among teachers in Malaysia. Such courses and training can help teachers increase their confidence and knowledge in digital teaching and learning, plan appropriate methods for their respective subjects, and provide information and skills to all teachers so they can apply technology in their classrooms. As shown by Rubach & Lazarides (2021), teachers who attended digital skills courses demonstrated greater knowledge and skills than those who did not. Another study by Özkara & Kalkavan (2021) explored the implications of gender representation among PE teachers and found that both male and female teachers contribute similarly to educational outcomes in physical education. The research suggests that the gender of the teacher does not significantly influence the effectiveness of physical education instruction; rather, it is their qualifications, teaching practices, and professional development that matter.

The Institute of Teacher Education (IPG) also offers compulsory courses for technology in Teaching and Learning (T&L) and digital innovation. These courses enable them to produce high-quality digital materials and gain exposure to managing resources and T&L media efficiently to support the teaching and learning process in school. Anuar et al. (2019) found that students at Universiti Pendidikan Sultan Idris in Perak had a high degree of digital abilities. According to the Malaysian Communication and Multimedia Commission (2022), young individuals aged 15 to 39 use the internet more than those aged 40 and up. Hence, younger teachers presumably have a higher level of digital literacy, while the government provides digital skills improvement courses for all teachers, regardless of age or gender. Where Teacher Professionalism is concerned, according to UNESCO Institute for Statistics (2018), it also requires digital

skills which are most necessary at this time of pre-service and in-service professionalism. Digital competence is integrated into didactical teaching, thus consideration is given to teacher digital skills and teaching with technology. Digital literacy is taken into account for teacher appointments and further professional development. Digital reality requires trained human resources with higher skills and digital literacy for higher competitiveness in socio-economic, socio-cultural, socio-educational and socio-technical fields. Properly trained technology leaders should be exposed and subjected to the proper dimensions of digital awareness that will enable them to fulfill the goals of the ministry.

Previous studies, for instance, West et al. (2019), emphasized the importance of focusing on the quality of physical education instruction rather than on teachers' gender. Educational policies and practices should aim to support all PE teachers equally, regardless of gender, and ensure that both male and female educators have access to professional development opportunities and resources to enhance their teaching effectiveness.

The fifth research question addresses whether there is a difference in the digital skills construct between rural and urban areas among PE teachers in Selangor. Like the two previous research questions, the study found no differences in information and data literacy, communication and collaboration, creation of digital content, teaching, facilitation, and assessment among genders among PE teachers in Selangor. This finding shows that PE teachers in the Selangor area, regardless of gender, have the same level of digital skills, as measured by the researcher. Although past studies have reported differences between male and female teachers in digital skills (González & Martín, 2018), this is not the case in Selangor for several reasons. The two factors that affect teachers' digital skills are internet access and teachers' (including administrators') willingness to ensure that the application of digital applications. As mentioned in the First Meeting of the Sixth Term of the Selangor State Assembly in 2023, until the fourth quarter (Q4) of 2022, Phase 1 of the state of Selangor WINDOW project had achieved several milestones, as follows: 1) 4G coverage in populated areas is 99.87% surpassing the national target of 96.9% 2) The average mobile broadband speed was 150.37Mbps exceeding the national target of 35Mbps. In addition, 421 new transmitter structures have been built, while 29 are still under construction. A total of 8,372 transmitting stations have been upgraded, and 567,943 premises have been covered with optical fibre in Selangor.

Furthermore, Digital Nasional Berhad (DNB) has assigned 1,871 5G development sites for the state of Selangor. As of February 22, 2023, 878 locations were operational. The remainder of the property is presently in the planning and procurement phases. This 5G network will be spread across all districts of Selangor, reducing the digital divide in society. The Malaysian Communications and Multimedia Commission (MCMC) has also provided satellite internet services (BWA) to five (5) Orang Asli Villages in Selangor to ensure this population is not marginalized. The Selangor State Government, through SMARTSEL Sdn Bhd (a subsidiary of the Menteri Besar Pengerajaan), works with the MCMC and telecommunications firms to ensure that JENDELA projects are executed as planned. The JENDELA Phase 2 plan (2023-2025) aims to close the digital divide in rural areas by achieving 100% 4G coverage in inhabited areas, 100 Mbps internet access with 5G adaptation, and 9 million premises with fiber-optic coverage (fixed broadband). The Selangor state government's initiative for internet access and facilities allows not only students but also teachers to improve their digital literacy.

The Technology Continuance Theory (TCT) links digital literacy achievement with continued use of ICT for teaching and learning because users are satisfied with their ICT provision and feel that their digital literacy skills improve. Where network facilities and internet provision genuinely exist at the highest level, teachers believe that technology will be used more optimally and effectively; thus, teacher satisfaction increases as they intend to use technology more effectively.

Le Yee & Mohamed (2021) and Mohamad Sidek & Mahmud (2024) reported that the level of digital skills among teachers in Selangor is high, as factors contributing to this include infrastructure such as internet networks and wide access. Thus, regardless of the quality of access to the internet's infrastructure and infostructure, teachers from both genders continue to enhance their digital skills.

The administrators' leadership practices also have an impact at the digital level among teachers. This aligns with a study by Fahmi et al. (2024), which found that leadership can encourage and motivate teachers to embrace digitalization for educational purposes. The line of school leadership in Selangor is seen as very high in integrating technology into school education (Ong & A. Hamid, 2023). As a result, teachers are motivated to expand the application of technology in education. This is because, in SDT, motivation—whether extrinsic or intrinsic—helps teachers overcome obstacles and challenges in learning digital skills and techniques suitable for teaching

and learning in the classroom. Support from the school leadership line indirectly contributed to the findings, which showed no difference in information and data literacy, communication and collaboration, creation of digital content, teaching, facilitation, and assessment among PE teachers in urban and rural areas in Selangor.

Due to access to high-quality internet networks and administrators' willingness to integrate ICT in schools, male and female teachers are better prepared to improve their digital skills. This is in line with a study by Kwan et al. (2023), which reported that one barrier separating the genders is access to the internet. In conclusion, the government, state, and school administrators' initiatives contributed to a similar level of digital skills among PE teachers across genders and age groups in Selangor.

5.2 Recommendation

The quality of PE in Malaysian schools can be improved by addressing limitations in infrastructure, resources, and policy . PE is different from other subjects because it involves the cognitive, psychomotor, and affective domains, and teachers are required to use access to advanced tools for effective teaching and assessment (Gallagher, 2020). Teachers can better be supported in developing holistic competencies. Enhancing the digital infrastructure by equipping them with modern technology, and putting a focus on PE at a national policy level,

1. Expand Digital Infrastructure for Access to Learning Resources

Digital infrastructure is crucial for modernizing Malaysia's education system, there is still vast networking disparities between urban and rural institutes of learning. Schools in rural areas often have insufficient internet connectivity which prevent teachers from using web-based tools and techniques during lessons (Nordin et al., 2023). Improving network access across all schools and bandwidth capacity can help , PE teachers will acquire more effective ways to improve the curriculum, such as using dynamic online platforms, multimedia resources, and digital assessments for teaching At the same time, digitization of the national education system alligned with Malaysia's vision, as stated in the Malaysia Education Blueprint (2013-2025) (Shah, 2022), to produce a society that is well-versed in technology.

2. Provide High-Performance Equipment and Advanced Applications

High-resolution cameras and AR apps are some of the specialized tools needed for capturing and identifying developments and programming for dynamic learning in PE. These innovations enable teachers to provide meaningful feedback on students' physical skills, which is particularly important for developing psychomotor abilities (Casey et al., 2017). AR applications, for instance, can create immersive learning experiences by visually demonstrating complex body movements, helping students understand and replicate intricate movement patterns (Kwan et al., 2023). By providing teachers with such up-to-date resources, they can elevate the learning experience beyond the classroom. One can learn by doing and not just watching - particularly when it comes to complex movements. Thus, these lessons can be virtual or in person as well since a lesson that crosses the two would encompass various perspectives and benefit from an interdisciplinary perspective (Kwan et al., 2023).

3. National-Level Assessment and Policy Emphasis

Unlike science and math, there are no standardized testing for PE. In this regard PE is considered the least worthy course due to the lack of standardized testing. Standardized testing for PE would validate the subject and a national standardized assessment for PE would bring benefits to the students' physical, mental and social growth (Coulter & Ní Chróinín, 2013). Therefore, national standardized assessments would equalize PE with other subjects, allowing for more resource allocations.

This recommendation draws on research and policies to address the infrastructure, resource, and policy gaps in Malaysia. Another recommendation aims to create a supportive environment for PE teachers to build and sustain their digital skills and to integrate technology effectively into their teaching. By providing access to resources, training, and a national support system, these strategies help PE teachers become confident, tech-savvy educators who can deliver modern, engaging PE lessons, thereby supporting their ability to provide high-quality, holistic education. The provision of comprehensive support through various strategies, each tailored to the unique context and needs of these educators, is imperative in enhancing digital skills among PE teachers in Selangor and across Malaysia:

1. Develop Comprehensive Digital Literacy Programs Tailored to PE Needs

A program to accommodate PE teacher digital literacy requirements could be established. A PE digital literacy program would include the above-mentioned applications of technology for movement analysis, fitness assessments, and game-based learning. A PE digital literacy program would consist of a familiarity component (how to use tablets, cameras, and laptops) and a more advanced component (how to implement AR for sports skill learning, video software for movement analysis, fitness wearable assessments) (Casey et al., 2016). The program can be streamed live and recorded to accommodate other teachers.

2. Create PE-Dedicated Digital Learning Centers in Schools

A digital learning center with PE-specific technologies should be established as to facilitate digital learning. It could operate for teacher development and student engagement where PE teachers visit this center to learn about opportunities to use necessary technologies. For example, video recording of student movements can give educators appropriate feedback in a more detailed manner and inform the strategies required to hone athletic skills. Access to the center on a regularly recurring basis and with established guidelines would allow educators to incorporate digital learning into their daily learning routines.

3. Integrate Augmented Reality (AR) and Virtual Reality (VR) Training in PE Curriculum

AR and VR technology can also transform learning in PE as they provide immersive experiences. Such technology would allow students to practice skills in a virtual realm or comprehend how their bodies are moving in the moment through an almost instant perspective. Teacher training PE teachers with AR and VR technology would make PE a more versatile and vibrant subject applicable to many physical environments (Mokmin & Ridzuan, 2022). For instance, AR can project 3D images of anatomy from a student's classroom desk. VR simulations can create a sports training environment that might not be feasible with equipment or space.

4. Facilitate Partnerships with Technology Providers and Educational Institutions

There are opportunities to partner with EdTech businesses and nearby universities to expose PE teachers to digital offerings and continued education. Technology companies can hold workshops and offer presentations/licenses at a reduced rate for PE-related software while universities can offer researched based presentations and access to expertise. Furthermore, the ability to attend graduate courses through universities can expose PE teachers to digital literacy/sports tech courses to not only expand their PE credentials but also their professional networks.

5. Establish a Digital Skills Certification Program for PE Teachers

A certification course for digital skills for PE teachers could give credit and recognition to teachers who seek to improve their digital skills. Such certification courses could cover virtual applications in the PE classroom, data analysis for assessing student fitness over time, and guidance for virtual student engagement. Teachers who complete this course get professional development hours credited to recertification and tenure requirements. This incentive fosters a willingness to take the course and adds spoken value to other teachers who need to listen to the significance of digital reskilling.

6. Offer Incentives for Digital Skill Acquisition and Integration in PE

Providing financial or professional incentives (stipends, recognition, promotions) for undergoing digital skills training for subsequent classroom implementation would encourage additional PE teachers to get on board. For example, if digital assessments or wearable devices to assess physical fitness are used, a bonus stipend could be provided to the PE department budget or professional acknowledgment for such use. At the same time, even the suggestion of using digital tools could create a collaborative atmosphere of continued professional growth among the teachers, with digital literacy as a newfound skill for 21st-century PE.

7. Implement a Peer-to-Peer Mentorship Program on Digital Skills

Establishing a mentorship program whereby teacher-techies effectively support their peers toward becoming digitally literate would foster a more comfortable, collaborative learning environment. These peer mentors would conduct mini-workshops, offer one-on-one support, and answer digital dilemmas. Digital literacy increases through mentorship as a more familiar learning environment comes with a lower threshold for fear that's otherwise commonly experienced with new technology. This is an essential bridge for those teachers who are unsure about using the tools or when they feel anxious and overwhelmed.

8. Launch an Online Resource Portal for Digital PE Tools and Lesson Plans

An online digital hub for PE educators might feature everything from tutorial videos to lesson plan templates to fitness apps and illustrations of digital integration success in PE. Furthermore, the comments section can be transformed into a discussion board where educators can add to the mix with useful tidbits, personal stories of success, and challenges they've encountered. Consolidating all digital resources into one singular location means that PE educators do not need to be perennially on the search for other resources.

9. Encourage Participation in Digital Pedagogy Conferences and Webinars

Digital literacy conferences, webinars and online workshops are a perfect way for educators to stay up to date on technology and techniques. Hosting a regional or national digital literacy conference for PE educators could help teacher awareness from an expert level and bring new ideas to the table during peer collaboration. For instance, video assessment, digital fitness tracking, AR/VR in PE classroom assessment could raise awareness through like-minded, digitally literate, PE professionals about up-and-coming practices. .

10. Integrate Digital Skills Modules into Teacher Education Programs for PE

Digital literacy courses for PE would be beneficial for pre-service educators, as well. This would provide newer professionals with a baseline understanding of available options and how to bring digital offerings into the classroom. This course would include digitally collected information for digital contributions, software for performance evaluation and AR/VR concepts. While these concepts could be university based, , they could be part of a partnership with school systems to provide pre-service educators with the latest standards for the classroom and digital environment to reduce the transition period from graduation to employment.

11. Create a National Framework for Digital Skills Development in PE

The MOE should implement a national digital competence framework for PE teachers which facilitates clear digital competence goals, standardized training and funding for digital inclusion. This framework would provide precise expectations of digital skills for PE teachers at various stages of professional development and could be an extension of Malaysia's larger Educational Technology Implementation Plan. This would advocate for PE teachers in all realms and ensure that all are included, resources are always present, developed digital skills are the same across the institutions, and schools are motivated to appropriately implement technology in their PE classes. .

12. Provide School-Based Support Staff for Technology Integration in PE

Technology support within the school can assist teachers with the proper maintenance and use of digital resources and devices applicable to PE. Support will help them with implementation/troubleshooting and new device set-up. They can review and maintain devices to ensure that they're always up and running and accessible at a moment's notice. Thus, the digital component of digital resources will not impede a PE professional's confidence in bringing digital resources into the classroom.

5.3 Conclusion

This study presents a valid and reliable instrument that can be used to measure digital competence among PE teachers. The study had verified that all constructs and items are psychometrically sound for use with the target population. The instrument provides constructs tailored to physical education teachers. For PE teachers in Selangor, encompassing information and data literacy, communication and collaboration, creation of digital content, problem solving, security, teaching, learning, and assessment, construct facilitates the identification of digital strengths and gaps, informs targeted professional development, enhances pedagogical practices, and supports the effective integration of technology in interactive and movement-based instruction. Consequently, the instrument contributes to both academic knowledge and the practical development of PE teachers' digital skills within the local educational context.

From a practical perspective, the findings offer policymakers evidence-based insights to design targeted professional development programmes and infrastructure investment strategies, ensuring that teacher upskilling initiatives align with national digital transformation objectives under Jalinan Digital Negara (JENDELA). By addressing the interplay among technological access, pedagogical competence, and contextual equity, this study enriches the body of knowledge. It provides digital skills constructs to advance digital education, specifically supporting the development of PE teaching practices in Selangor.

To summarise, digital technology offers a new learning experience distinct from traditional teaching methods. Its use is advantageous as it can be used to enhance the teaching and learning process, provides flexibility in teaching and allows immediate access to information. In the meantime, while the teachers perceive that they have training and knowledge in digital literacy, its application in physical education teaching and learning is still limited.

Notably, the study found that with regard to the use digital skills in physical education, there is no disparity competence levels between gender . Conversely, age and teaching experience have shown some influence on digital competence. Younger teachers showed high technological knowledge, and they tend to use digital tools more in physical education than older teachers.

This study recommends that future studies in physical education delve deeper into identifying deficiencies in the use of technological resources in schools. It is also

advantageous to study the potential variations in resource availability across different school types and analyze a more diverse sample population and to incorporate other variables related to teaching \. However, researchers should exercise caution in generalizing the findings to the broader population.

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APPENDICES

APPENDIX 1

Approval Letter from MOE



KEMENTERIAN PENDIDIKAN MALAYSIA
BAHAGIAN PERANCANGAN DAN PENYELIDIKAN DASAR PENDIDIKAN

ARAS 1-4, BLOK E KOMPLEKS KERAJAAN PARCELE
PUSAT PENTADBIRAN KERAJAAN PERSEKUTUAN
62604 PUTRAJAYA

TEL : 0388846591
FAXS : 0388846579

Ruj. Kami : KPM.600-3/2/3-eras(16712)
Tarikh : 19 Jun 2023

HASNIDA HANIM BINTI AHMAD KAMIL
NO. KP : 800621085840

NO:63 JALAN PP 2/11 TAMAN PUTRA PRIMA
PUCHONG, SELANGOR 47130 PUCHONG
SELANGOR

Tuan,

**KELULUSAN BERSYARAT UNTUK MENJALANKAN KAJIAN :
PEMBANGUNAN SOAL SELIDIK KEMAHIRAN DIGITAL DALAM KALANGAN GURU PENDIDIKAN JASMANI DI SELANGOR**

Perkara di atas adalah dirujuk.

2. Sukacita dimaklumkan bahawa permohonan tuan untuk menjalankan kajian seperti di bawah telah diluluskan dengan syarat :

"**KELULUSAN INI BERGANTUNG KEPADA KEBENARAN PENGARAH JPN DAN PERTIMBANGAN PENTADBIR SEKOLAH. PENGUTIPAN DATA TERMA SUK SECARA DALAM TALIAN (CONTOH: GOOGLE FORM) PERLU MENDAPATKAN KEBENARAN PENGARAH JPN DAN PERTIMBANGAN PENTADBIR SEKOLAH.**"

3. Kelulusan adalah berdasarkan kepada kertas cadangan penyelidikan dan instrumen kajian yang dikemukakan oleh tuan kepada bahagian ini. Walau bagaimanapun kelulusan ini bergantung kepada kebenaran Jabatan Pendidikan Negeri dan Pengetua / Guru Besar yang berkenaan.

4. Surat kelulusan ini sah digunakan bermula dari 20 Jun 2023 hingga 15 Disember 2023

5. Tuan dikehendaki menyerahkan senaskhah laporan akhir kajian dalam bentuk *hardcopy* bersama salinan *softcopy* berformat pdf dalam CD kepada Bahagian ini. Tuan juga diingatkan supaya mendapat kebenaran terlebih dahulu daripada Bahagian ini sekiranya sebahagian atau sepenuhnya dapatan kajian tersebut hendak diterbitkan di mana-mana forum, seminar atau diumumkan kepada media massa.

Sekian untuk makluman dan tindakan tuan selanjutnya. Terima kasih.

"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

Ketua Penolong Pengarah Kanan Sektor
Penyelidikan dan Penilaian Dasar b.p.
Pengarah
Bahagian Perancangan dan Penyelidikan Dasar Pendidikan
Kementerian Pendidikan Malaysia

APPENDIX 2

Approval Letter - UiTM Research Ethics Committee

www.uitm.edu.my



Pejabat
Timbalan Naib Canselor
(Penyelidikan dan Inovasi)

Reference : 800-TNCPI (5/1/8)
Our reference : REC/09/2023 (PG/MR/345) Date
: 15 September 2023

Dr Zarizi bin Ab Rahman
(Hasnida Hanim binti Ahmad Kamil – 2021139785)
Faculty of Education
Universiti Teknologi MARA
Puncak Alam Campus
42300 Bandar Puncak Alam
SELANGOR

Dear Dr Zarizi,

APPROVAL LETTER - UiTM RESEARCH ETHICS COMMITTEE

Thank you for submitting your research proposal to the Research Ethics Committee (REC). After considering your application, the Committee approved your proposal titled "The Development of Digital Skills Questionnaire among Physical Education Teachers in Selangor" in Petaling Utama, Kuala Selangor, Klang and Kuala Langat District.

Details of the approval are as follows:

Ref. number:	REC/09/2023 (PG/MR/345)
Approval Period:	15 September 2023 until 31 December 2023
Authorised personnel:	1. Dr Zarizi bin Ab Rahman 2. Hasnida Hanim binti Ahmad Kamil

The UiTM Research Ethics Committee operates in accordance to the ICH Good Clinical Practice Guidelines, Malaysian Good Clinical Practice Guidelines and the Declaration of Helsinki. The approval of this project is conditional upon your continuing compliance with these guidelines and declaration.

We draw to your attention the requirement that a report on this research, must be submitted every 12 months from the date of the approval or on the completion of the project, whichever occurs first. Failure to submit reports will result in withdrawal of consent for the project to proceed. Amendments, if any, to the study documents are to be submitted to the REC for approval.

If you require further information, please contact the REC Secretariat at 03-55448069/0355442794 or email at recsecretariat@uitm.edu.my.

Yours sincerely,

EMERITUS
Chairman

PROFESSOR DATO' DR RAYMOND AZMAN ALI

Universiti Teknologi MARA
Aras 3, Bangunan Wawasan
40450 Shah Alam, Selangor, MALAYSIA
Tel: (+603) 5544 2004/2255
Faks: (+603) 5544 2070



APPENDIX 3

Questionnaire – 43 items



اَوْنُوْرُسِيْتِي تِيْكُوْلُوْكَى مِيْمَارَا
UNIVERSITI
TEKNOLOGI
MARA

Assalamualaikum wbt. and good day. I am a student from Part 6 Master of Education in Physical Education in UiTM Puncak Alam. I am currently conducting a survey for *EDU 750: Research Methodology for Physical Education* subject regarding **THE DEVELOPMENT OF DIGITAL SKILLS QUESTIONNAIRE AMONG PHYSICAL EDUCATION TEACHERS**. Therefore, your cooperation in completing this questionnaire would be highly appreciated as it will be used as our data for academic and research purposes. Your answers are going to be used for research purposes and it will be kept anonymous. *The survey will take approximately 30-60 minutes to complete.*

Assalamualaikum wbt. dan salam sejahtera. Saya merupakan pelajar Semester 6 Sarjana Pendidikan dalam pengkhususan Pendidikan Jasmani di UiTM Puncak Alam. Saya sedang menjalankan tinjaun untuk subjek *EDU 750: Research Methodology for Physical Education* mengenai **PEMBANGUNAN SOAL SELIDIK KEMAHIRAN DIGITAL DALAM KALANGAN GURU PENDIDIKAN JASMANI**. Oleh itu, kerjasama anda dalam melengkapkan soal selidik ini amat dihargai kerana ia akan digunakan sebagai data kami untuk tujuan akademik dan penyelidikan. Jawapan anda akan digunakan untuk tujuan penyelidikan dan sebarang maklumat adalah sulit. *Tinjaun akan memakan masa lebih kurang 30 - 60 minit untuk diselesaikan.*

SECTION A – Demographic Information

Bahagian A – Maklumat Demografi

Directions: Please read each statement carefully and fill in / tick your answer.

Arahan: Sila baca setiap pertanyaan dengan teliti dan tulis / tanda jawapan anda.

1) School / Sekolah

☐ Secondary School / Sekolah Menengah

☐ Primary School / Sekolah Rendah

2) School Category / Kategori Sekolah

☐ Urban / Bandar

☐ Rural / Luar Bandar

3) Age / Umur: _____ years/ tahun.

4) Gender / Jantina

☐ Male / Lelaki

☐ Female / Perempuan

5) How many years of teaching experience in Physical Education subject?

Berapa tahunkah pengalaman mengajar dalam subjek Pendidikan Jasmani?

_____ years/tahun.

6) Ever attended a course in digital skills.

Pernah menghadiri kursus kemahiran digital.

☐ Yes / Ya

☐ No / Tidak

7) Field / Pengkhususan:

☐ Physical Education / PJK

☐ Others / Lain-lain

SECTION B – Digital Skills

BAHAGIAN B – Kemahiran Digital

Directions: For each statement, please indicate your answer using the following scale:

Arahan: Bagi setiap pertanyaan, sila nyatakan jawapan ada mengikut skala berikut:

Strongly Disagree / Sangat Tidak Setuju	Disagree / Tidak Bersetuju	Not Sure / Tidak Pasti	Agree / Bersetuju	Strongly Agree / Sangat Bersetuju
1	2	3	4	5

No.	Questions / Soalan	1	2	3	4	5
	TEACHING, LEARNING, AND ASSESSMENT					
1.	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes. <i>Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz / Kahoot / Wordwall dan lain-lain.</i>					
2.	The online quiz's time allocated is sufficient. <i>Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.</i>					
3.	I find it easy to learn something by reading from digital devices. <i>Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.</i>					
4.	I use websites to support my teaching in Physical Education subject. <i>Saya menggunakan laman web untuk membantu pengajaran saya dalam subjek Pendidikan Jasmani.</i>					
5.	I use computer for teaching and facilitation (PdPc) purpose for Physical Education subject. <i>Saya menggunakan komputer untuk tujuan pengajaran dan pemudahcaraan (PdPc) bagi subjek Pendidikan Jasmani.</i>					
6.	I fairly evaluate each homework that students turn in using the online application.					

No.	Questions / Soalan	1	2	3	4	5
	<i>Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.</i>					
7.	I can create a basic Word Document for my teaching and facilitation (PdPc) purposes. <i>Saya dapat mencipta dokumen Word asas untuk tujuan pengajaran dan pemudahcaraan (PdPc).</i>					
8.	I can search information for Physical Education subject using a web search engine for teaching and facilitation (PdPc). <i>Saya dapat mencari maklumat untuk subjek Pendidikan Jasmani menggunakan enjin carian web bagi tujuan pengajaran dan pemudahcaraan (PdPc).</i>					
	INFORMATION AND DATA LITERACY					
9.	I can use media devices to present information to the students. <i>Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid.</i>					
10.	I find it is easy to find a website I visited before. <i>Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.</i>					
11.	I can use media devices such as laptop, handphone, computer as teaching aids (BBM/ABM) for Physical Education subject. <i>Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.</i>					
12.	When I use the internet to research a topic related to physical education, I feel extremely motivated. <i>Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.</i>					
13.	I can use different sources of information such as Google/You Tube/ Yahoo! for Physical Education subject. <i>Saya boleh menggunakan pelbagai sumber informasi seperti Google/You Tube/Yahoo! untuk subjek Pendidikan Jasmani.</i>					

No.	Questions / Soalan	1	2	3	4	5
14.	I can use media devices to communicate with students. <i>Saya dapat menggunakan pelbagai peranti media untuk berkomunikasi dengan murid.</i>					
15.	I can create media content by using PowerPoint/ Microsoft Word /Google Meet for Physical Education subjects. <i>Saya dapat menghasilkan bahan media menggunakan Power Point/ Microsoft Word/Google Meet untuk subjek Pendidikan Jasmani.</i>					
	CREATION OF DIGITAL CONTENT					
16.	Through online media platforms, I share the personal media that I create, such as digital art with my students. <i>Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian.</i>					
17.	I collectively with other physical education teachers build digital instructional tools for my students. <i>Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.</i>					
18.	I am familiar with the rules of the user agreements for websites where I produce. <i>Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.</i>					
19.	I employ image editing applications to adapt audiovisual material to my online teaching and facilitation (PdPc) purposes. <i>Saya menggunakan aplikasi sunting imej untuk menyesuaikan bahan audio-visual dengan keperluan pengajaran dan pemudahcaraan (PdPc) dalam talian saya.</i>					
20.	I learn how to use media platform for developing digital educational content by watching online tutorials. <i>Saya belajar cara menggunakan platform media untuk memperoleh kandungan pendidikan digital dengan menonton tutorial dalam talian.</i>					

No.	Questions / Soalan	1	2	3	4	5
21.	I always keep the source of any data I obtain from any platform in my digital devices. <i>Saya sentiasa menyimpan data yang saya dapat daripada pelbagai platform sebagai dokumen dalam peranti digital saya.</i>					
22.	I can make any changes of information during online teaching for Physical Education subject on my digital devices. <i>Saya boleh membuat sebarang perubahan maklumat semasa pengajaran dalam talian untuk mata pelajaran Pendidikan Jasmani pada peranti digital saya</i>					
23.	I have experience using resources that will benefit my online teaching. <i>Saya mempunyai pengalaman menggunakan sumber yang dapat membantu saya untuk pengajaran dalam talian.</i>					
	COMMUNICATION AND COLLABORATION					
24.	I am aware of the existence of the educational social networks. <i>Saya sedar dengan kewujudan rangkaian sosial pendidikan.</i>					
25.	I know how to use emoticons. <i>Saya tahu cara menggunakan emoji.</i>					
26.	I use digital technologies to communicate in online environments. <i>Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.</i>					
27.	I can make decision of which media platform to follow online. <i>Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.</i>					
28.	I am satisfied with my ability to adapt the changes in technology. <i>Saya sangat berpuas hati dengan kebolehan saya untuk menyesuaikan diri dengan perubahan teknologi.</i>					

No.	Questions / Soalan	1	2	3	4	5
29.	For teaching materials of physical education, I use information from the internet. <i>Sebagai bahan pengajaran pendidikan jasmani, saya menggunakan informasi daripada internet.</i>					
30.	I know which information I should share online. <i>Saya tahu maklumat mana yang patut saya kongsi dalam talian.</i>					
31.	I know how to remove friends from my platform media lists (e.g Tiktok, Instagram, Facebook). <i>Saya tahu cara mengeluarkan rakan daripada senarai platform media saya (e.g Tiktok, Instagram, Facebook).</i>					
	PROBLEM-SOLVING					
32.	I can identify the causes of technical problems when using digital devices. <i>Saya dapat mengenal pasti punca masalah teknikal apabila menggunakan peranti digital.</i>					
33.	I can solve the technical problem I encounter when using digital devices. <i>Saya dapat menyelesaikan masalah teknikal yang saya hadapi apabila menggunakan peranti digital.</i>					
34.	I can update my anti-virus software on my computer. <i>Saya boleh mengemas kini perisian anti-virus saya pada komputer saya.</i>					
35.	I am familiar with a variety of media file formats. <i>Saya biasa dengan pelbagai format fail media.</i>					
36.	I have addressed various technical problems with my digital equipment, through online communication. <i>Saya telah menangani pelbagai isu teknikal dengan peranti digital saya melalui komunikasi dalam talian.</i>					
	SECURITY					
37.	I develop my digital competence by always following new developments.					

No.	Questions / Soalan	1	2	3	4	5
	<i>Saya meningkatkan kompetensi digital saya dengan sentiasa mengikuti perkembangan baru.</i>					
38.	I can evaluate the trustworthiness of information found on the internet. <i>Saya dapat menilai kesahihan maklumat yang terdapat di Internet.</i>					
39.	I am aware of how to overcome for students who are addicted to digital. <i>Saya tahu bagaimana cara untuk mengatasi murid yang ketagihan digital.</i>					
40.	There is enough cooperation between teachers for ICTs issues. <i>Terdapat kerjasama yang cukup antara guru berkenaan isu teknologi maklumat.</i>					
41.	I use protection software such as antivirus on all my devices. <i>Saya menggunakan perisian perlindungan seperti antivirus pada semua peranti saya.</i>					
42.	To avoid physical harm, I keep track of how much time I spend online. <i>Saya mengambil tahu mengenai tempoh masa yang saya luangkan dalam talian untuk mengelakkan kemudaratan fizikal.</i>					
43.	I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression. <i>Saya sedar tentang risiko kesihatan yang berkaitan dengan penyalahgunaan teknologi seperti obesiti /gangguan penglihatan/kemurungan.</i>					

THANK YOU

TERIMA KASIH

APPENDIX 4

Questionnaire – 17 items



اَوْنُوْرَسِيْتِي تِيَكُوْلُوْكَى مِيَارَا
UNIVERSITI
TEKNOLOGI
MARA

Assalamualaikum wbt. and good day. I am a student from Part 6 Master of Education in Physical Education in UiTM Puncak Alam. I am currently conducting a survey for *EDU 750: Research Methodology for Physical Education* subject regarding **THE DEVELOPMENT OF DIGITAL SKILLS QUESTIONNAIRE AMONG PHYSICAL EDUCATION TEACHERS**. Therefore, your cooperation in completing this questionnaire would be highly appreciated as it will be used as our data for academic and research purposes. Your answers are going to be used for research purposes and it will be kept anonymous. *The survey will take approximately 30-60 minutes to complete.*

Assalamualaikum wbt. dan salam sejahtera. Saya merupakan pelajar Semester 6 Sarjana Pendidikan dalam pengkhususan Pendidikan Jasmani di UiTM Puncak Alam. Saya sedang menjalankan tinjaun untuk subjek *EDU 750: Research Methodology for Physical Education* mengenai **PEMBANGUNAN SOAL SELIDIK KEMAHIRAN DIGITAL DALAM KALANGAN GURU PENDIDIKAN JASMANI**. Oleh itu, kerjasama anda dalam melengkapkan soal selidik ini amat dihargai kerana ia akan digunakan sebagai data kami untuk tujuan akademik dan penyelidikan. Jawapan anda akan digunakan untuk tujuan penyelidikan dan sebarang maklumat adalah sulit. *Tinjaun akan memakan masa lebih kurang 30 - 60 minit untuk diselesaikan.*

SECTION A – Demographic Information

Bahagian A – Maklumat Demografi

Directions: Please read each statement carefully and fill in / tick your answer.

Arahan: Sila baca setiap pertanyaan dengan teliti dan tulis / tanda jawapan anda.

1) School / Sekolah

☐ Secondary School / Sekolah Menengah

☐ Primary School / Sekolah Rendah

2) School Category / Kategori Sekolah

☐ Urban / Bandar

☐ Rural / Luar Bandar

3) Age / Umur: _____ years/ tahun.

4) Gender / Jantina

☐ Male / Lelaki

☐ Female / Perempuan

5) How many years of teaching experience in Physical Education subject?

Berapa tahunkah pengalaman mengajar dalam subjek Pendidikan Jasmani?

_____ years/tahun.

6) Ever attended a course in digital skills.

Pernah menghadiri kursus kemahiran digital.

☐ Yes / Ya

☐ No / Tidak

7) Field / Pengkhususan:

☐ Physical Education / PJK

☐ Others / Lain-lain

SECTION B – Digital Skills

BAHAGIAN B – Kemahiran Digital

Directions: For each statement, please indicate your answer using the following scale:

Arahan: Bagi setiap pertanyaan, sila nyatakan jawapan ada mengikut skala berikut:

Strongly Disagree / Sangat Tidak Setuju	Disagree / Tidak Bersetuju	Not Sure / Tidak Pasti	Agree / Bersetuju	Strongly Agree / Sangat Bersetuju
1	2	3	4	5

No.	Questions / Soalan	1	2	3	4	5
	TEACHING, LEARNING, AND ASSESSMENT					
1.	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes. <i>Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz / Kahoot / Wordwall dan lain-lain.</i>					
2.	I am aware about the ethics of online teaching and facilitation (PdPc) purposes. <i>Saya sedar tentang etika pengajaran dan pembelajaran (PdPc) dalam talian.</i>					
3.	I follow ethical principles when using content belong to others in digital environment. <i>Saya mematuhi prinsip etika apabila menggunakan kandungan milik orang lain dalam persekitaran digital.</i>					
4.	The online quiz's time allocated is sufficient. <i>Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.</i>					
5.	I find it easy to learn something by reading from digital devices. <i>Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.</i>					

No.	Questions / Soalan	1	2	3	4	5
6.	I fairly evaluate each homework that students turn in using the online application. <i>Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.</i>					
	CREATION OF DIGITAL CONTENT					
7.	Through online media platforms, I share the personal media that I create, such as digital art with my students. <i>Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian.</i>					
8.	I collectively with other physical education teachers build digital instructional tools for my students. <i>Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.</i>					
9.	I am familiar with the rules of the user agreements for websites where I produce. <i>Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.</i>					
	INFORMATION AND DATA LITERACY					
10.	I can use media devices to present information to the students. <i>Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid.</i>					
11.	I find it is easy to find a website I visited before. <i>Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.</i>					
12.	I can use media devices such as laptop, handphone, computer as teaching aids (BBM/ABM) for Physical Education subject. <i>Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.</i>					

No.	Questions / Soalan	1	2	3	4	5
13.	When I use the internet to research a topic related to physical education, I feel extremely motivated. <i>Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.</i>					
	COMMUNICATION AND COLLABORATION					
14..	I am aware of the existence of the educational social networks. <i>Saya sedar dengan kewujudan rangkaian sosial pendidikan.</i>					
15..	I know how to use emoticons. <i>Saya tahu cara menggunakan emoji.</i>					
16.	I use digital technologies to communicate in online environments. <i>Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.</i>					
17.	I can make decision of which media platform to follow online. <i>Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.</i>					

THANK YOU

TERIMA KASIH

APPENDIX 5

Questionnaire – 16 items



اَوْنُوْرُسِيْتِي تِيْكُوْلُوْكَى مِيَارَا
UNIVERSITI
TEKNOLOGI
MARA

Assalamualaikum wbt. and good day. I am a student from Part 6 Master of Education in Physical Education in UiTM Puncak Alam. I am currently conducting a survey for *EDU 750: Research Methodology for Physical Education* subject regarding **THE DEVELOPMENT OF DIGITAL SKILLS QUESTIONNAIRE AMONG PHYSICAL EDUCATION TEACHERS**. Therefore, your cooperation in completing this questionnaire would be highly appreciated as it will be used as our data for academic and research purposes. Your answers are going to be used for research purposes and it will be kept anonymous. *The survey will take approximately 30-60 minutes to complete.*

Assalamualaikum wbt. dan salam sejahtera. Saya merupakan pelajar Semester 6 Sarjana Pendidikan dalam pengkhususan Pendidikan Jasmani di UiTM Puncak Alam. Saya sedang menjalankan tinjaun untuk subjek *EDU 750: Research Methodology for Physical Education* mengenai **PEMBANGUNAN SOAL SELIDIK KEMAHIRAN DIGITAL DALAM KALANGAN GURU PENDIDIKAN JASMANI**. Oleh itu, kerjasama anda dalam melengkapkan soal selidik ini amat dihargai kerana ia akan digunakan sebagai data kami untuk tujuan akademik dan penyelidikan. Jawapan anda akan digunakan untuk tujuan penyelidikan dan sebarang maklumat adalah sulit. *Tinjaun akan memakan masa lebih kurang 30 - 60 minit untuk diselesaikan.*

SECTION A – Demographic Information

Bahagian A – Maklumat Demografi

Directions: Please read each statement carefully and fill in / tick your answer.

Arahan: Sila baca setiap pertanyaan dengan teliti dan tulis / tanda jawapan anda.

1) School / Sekolah

☐ Secondary School / Sekolah Menengah

☐ Primary School / Sekolah Rendah

2) School Category / Kategori Sekolah

☐ Urban / Bandar

☐ Rural / Luar Bandar

3) Age / Umur: _____ years/ tahun.

4) Gender / Jantina

☐ Male / Lelaki

☐ Female / Perempuan

5) How many years of teaching experience in Physical Education subject?

Berapa tahunkah pengalaman mengajar dalam subjek Pendidikan Jasmani?

_____ years/tahun.

6) Ever attended a course in digital skills.

Pernah menghadiri kursus kemahiran digital.

☐ Yes / Ya

☐ No / Tidak

7) Field / Pengkhususan:

☐ Physical Education / PJK

☐ Others / Lain-lain

SECTION B – Digital Skills

BAHAGIAN B – Kemahiran Digital

Directions: For each statement, please indicate your answer using the following scale:

Arahan: Bagi setiap pertanyaan, sila nyatakan jawapan anda mengikut skala berikut:

Strongly Disagree / Sangat Tidak Setuju	Disagree / Tidak Bersetuju	Not Sure / Tidak Pasti	Agree / Bersetuju	Strongly Agree / Sangat Bersetuju
1	2	3	4	5

No.	Questions / Soalan	1	2	3	4	5
	TEACHING, LEARNING, AND ASSESSMENT					
1.	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes. <i>Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz / Kahoot / Wordwall dan lain-lain.</i>					
2.	I am aware about the ethics of online teaching and facilitation (PdPc) purposes. <i>Saya sedar tentang etika pengajaran dan pembelajaran (PdPc) dalam talian.</i>					
3.	I follow ethical principles when using content belong to others in digital environment. <i>Saya mematuhi prinsip etika apabila menggunakan kandungan milik orang lain dalam persekitaran digital.</i>					
4.	The online quiz's time allocated is sufficient. <i>Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.</i>					
5.	I find it easy to learn something by reading from digital devices. <i>Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.</i>					

No.	Questions / Soalan	1	2	3	4	5
6.	I fairly evaluate each homework that students turn in using the online application. <i>Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.</i>					
	CREATION OF DIGITAL CONTENT					
7.	Through online media platforms, I share the personal media that I create, such as digital art with my students. <i>Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian.</i>					
8.	I collectively with other physical education teachers build digital instructional tools for my students. <i>Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.</i>					
9.	I am familiar with the rules of the user agreements for websites where I produce. <i>Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.</i>					
	INFORMATION AND DATA LITERACY					
10.	I can use media devices to present information to the students. <i>Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid.</i>					
11.	I find it is easy to find a website I visited before. <i>Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.</i>					
12.	I can use media devices such as laptop, handphone, computer as teaching aids (BBM/ABM) for Physical Education subject. <i>Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.</i>					

No.	Questions / Soalan	1	2	3	4	5
13.	When I use the internet to research a topic related to physical education, I feel extremely motivated. <i>Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.</i>					
	COMMUNICATION AND COLLABORATION					
14..	I am aware of the existence of the educational social networks. <i>Saya sedar dengan kewujudan rangkaian sosial pendidikan.</i>					
15..	I know how to use emoticons. <i>Saya tahu cara menggunakan emoji.</i>					
16.	I use digital technologies to communicate in online environments. <i>Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.</i>					

THANK YOU

TERIMA KASIH

APPENDIX 6

Expert 1

CONTENT EXPERT

Construct Validity of Instrumentation: Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes. Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz/Kahoot/Wordwall dan lain-lain.		✓		
2.	The online quiz's time allocated is sufficient. Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.		✓		
3.	I find it easy to learn something by reading from digital devices. Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.			✓	
4.	I use websites to support my teaching in Physical Education subject. Saya menggunakan laman web untuk membantu pengajaran saya dalam subjek Pendidikan Jasmani.			✓	
5.	I use computer for teaching and facilitation (PdPc) purpose for Physical Education subject. Saya menggunakan komputer untuk tujuan pengajaran dan pemudahcaraan (PdPc) bagi subjek Pendidikan Jasmani.		✓		
6.	I fairly evaluate each homework that students turn in using the online application.				✓

	Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.				
7.	I can create a basic Word Document for my teaching and facilitation (PdPc) purposes. Saya dapat mencipta dokumen Word asas untuk tujuan pengajaran dan pemudahcaraan (PdPc).		✓		
8.	I can search information for Physical Education subject using a web search engine for teaching and facilitation (PdPc). Saya dapat mencari maklumat untuk subjek Pendidikan Jasmani menggunakan enjin carian web bagi tujuan pengajaran dan pemudahcaraan (PdPc).				✓
9.	I can use media devices to present information to the students. Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid			✓	
10.	I find it is easy to find a website I visited before. Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.				✓
11.	I can use media devices such as laptop, handphone, computer as teaching aids (BBM/ABM) for Physical Education subject. Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.		✓		
12.	When I use the internet to research a topic related to physical education, I feel extremely motivated. Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.				✓
13.	I can use different sources of information such as Google/You Tube/ Yahoo! for Physical Education subject. Saya boleh menggunakan pelbagai sumber informasi seperti Google/You Tube/Yahoo! untuk subjek Pendidikan Jasmani.				✓

14.	I can use media devices to communicate with students. Saya dapat menggunakan pelbagai peranti media untuk berkomunikasi dengan murid.	✓			
15.	I can create media content by using PowerPoint/ Microsoft Word /Google Meet for Physical Education subjects. Saya dapat menghasilkan bahan media menggunakan Power Point/ Microsoft Word/Google Meet untuk subjek Pendidikan Jasmani.			✓	
16.	Through online media platforms, I share the personal media that I create, such as digital art with my students. Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian	✓			
17.	I collectively with other physical education teachers build digital instructional tools for my students. Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.		✓		
18.	I am familiar with the rules of the user agreements for websites where I produce. Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.	✓			
19.	I employ image editing applications to adapt audio-visual material to my online teaching and facilitation (PdPc) purposes. Saya menggunakan aplikasi sunting imej untuk menyesuaikan bahan audio-visual dengan keperluan pengajaran dan pemudahcaraan (PdPc) dalam talian saya.	✓			
20.	I learn how to use media platform for developing digital educational content by watching online tutorials. Saya belajar cara menggunakan platform media untuk memperoleh kandungan pendidikan digital dengan menonton tutorial dalam talian.			✓	

21.	I always keep the source of any data I obtain from any platform in my digital devices. Saya sentiasa menyimpan data yang saya dapat daripada pelbagai platform sebagai dokumen dalam peranti digital saya.			✓	
22.	I can make any changes of information during online teaching for Physical Education subject on my digital devices. Saya boleh membuat sebarang perubahan maklumat semasa pengajaran dalam talian untuk mata pelajaran Pendidikan Jasmani pada peranti digital saya.			✓	
23.	I have experience using resources that will benefit my online teaching. Saya mempunyai pengalaman menggunakan sumber yang dapat membantu saya untuk pengajaran dalam talian.				✓
24.	I am aware of the existence of the educational social networks. Saya sedar dengan kewujudan rangkaian sosial pendidikan.				✓
25.	I know how to use emoticons. Saya tahu cara menggunakan emoji.				✓
26.	I use digital technologies to communicate in online environments. Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.				✓
27.	I can make decision of which media platform to follow online. Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.				✓
28.	I am satisfied with my ability to adapt the changes in technology. Saya sangat berpuas hati dengan kebolehan saya untuk menyesuaikan diri dengan perubahan teknologi				✓

29.	For teaching materials of physical education, I use information from the internet. Sebagai bahan pengajaran pendidikan jasmani, saya menggunakan informasi daripada internet.			✓	
30.	I know which information I should share online. Saya tahu maklumat mana yang patut saya kongsi dalam talian.				✓
31.	I know how to remove friends from my platform media lists (e.g Tiktok, Instagram, Facebook). Saya tahu cara mengeluarkan rakan daripada senarai platform media saya (e.g Tiktok, Instagram, Facebook).				✓
32.	I can identify the causes of technical problems when using digital devices. Saya dapat mengenal pasti punca masalah teknikal apabila menggunakan peranti digital.				✓
33.	I can solve the technical problem I encounter when using digital devices. Saya dapat menyelesaikan masalah teknikal yang saya hadapi apabila menggunakan peranti digital.				✓
34.	I can update my anti-virus software on my computer. Saya boleh mengemas kini perisian anti-virus saya pada komputer saya.				✓
35.	I am familiar with a variety of media file formats. Saya biasa dengan pelbagai format fail media.				✓
36.	I have addressed various technical problems with my digital equipment, through online communication. Saya telah menangani pelbagai isu teknikal dengan peranti digital saya melalui komunikasi dalam talian.				✓
37.	I develop my digital competence by always following new developments. Saya meningkatkan kompetensi digital saya dengan sentiasa mengikuti perkembangan baru.				✓

38.	I can evaluate the trustworthiness of information found on the internet. Saya dapat menilai kesahihan maklumat yang terdapat di Internet.				✓
39.	I am aware of how to overcome for students who are addicted to digital. Saya tahu bagaimana cara untuk mengatasi murid yang ketagihan digital.			✓	
40.	There is enough cooperation between teachers for ICTs issues. Terdapat kerjasama yang cukup antara guru berkenaan isu teknologi maklumat.			✓	
41.	I use protection software such as antivirus on all my devices. Saya menggunakan perisian perlindungan seperti antivirus pada semua peranti saya.				✓
42.	To avoid physical harm, I keep track of how much time I spend online. Saya mengambil tahu mengenai tempoh masa yang saya luangkan dalam talian untuk mengelakkan kemudaratan fizikal.				✓
43.	I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression. Saya sedar tentang risiko kesihatan yang berkaitan dengan penyalahgunaan teknologi seperti obesiti /gangguan penglihatan/kemurungan.				✓

Remarks:

Penggunaan teknologi di kalangan murid adalah susah untuk dilaksanakan secara realiti.

Ini kerana terdapat pekiling yang tidak membenarkan murid untuk membawa apa-apa

peranti ke sekolah. Selain itu, capaian internet di sekolah juga tiada. Guru PJKP juga perlu mematuhi nisbah 3:1 dalam PdPc PJKP dan PBD yang perlu dinilai berdasarkan kemahiran yang ditunjukkan oleh murid di mana ia sukar dicapai jika masa PdPc banyak digunakan dengan menggunakan teknologi digital.

Verified by,



Name : AZLI SHAH BIN ISMAIL WANG
Position : PEGAWAI PERKHIDMATAN PENDIDIKAN
Date : 22 JANUARI 2024

CONTENT EXPERT

Construct Validity of Instrumentation of Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Questions deal with significant topic to create understanding and interest among respondents.			✓	
2.	Direction of items are clear and complete.			✓	
3.	No double items in one question.				✓
4.	Items are appropriate to measure all the constructs.		✓		
5.	The items are appropriate to respondents.		✓		

Remarks:

Penggunaan peranti digital mungkin boleh digunakan kepada murid-murid sekolah harian

biasa dengan memberikan mereka tugas selepas waktu persekolahan. Tetapi

ia tidak boleh dilakukan ke atas murid-murid sekolah berasrama atau sekolah-sekolah pendalaman

Verified by,



Name : AZLI SHAH BIN ISMAIL WANG

Position : PEGAWAI PERKHIDMATAN PENDIDIKAN

Date : 22 JANUARI 2024

APPENDIX 7

Expert 2

CONTENT EXPERT

Construct Validity of Instrumentation: Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (√) in the space provided.

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes. Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz/Kahoot/Wordwall dan lain-lain.			√	
2.	The online quiz's time allocated is sufficient. Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.			√	
3.	I find it easy to learn something by reading from digital devices. Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.			√	
4.	I use websites to support my teaching in Physical Education subject. Saya menggunakan laman web untuk membantu pengajaran saya dalam subjek Pendidikan Jasmani.			√	
5.	I use computer for teaching and facilitation (PdPc) purpose for Physical Education subject. Saya menggunakan komputer untuk tujuan pengajaran dan pemudahcaraan (PdPc) bagi subjek Pendidikan Jasmani.				√
6.	I fairly evaluate each homework that students turn in using the online application.			√	

	Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.				
7.	I can create a basic Word Document for my teaching and facilitation (PdPc) purposes. Saya dapat mencipta dokumen Word asas untuk tujuan pengajaran dan pemudahcaraan (PdPc).				√
8.	I can search information for Physical Education subject using a web search engine for teaching and facilitation (PdPc). Saya dapat mencari maklumat untuk subjek Pendidikan Jasmani menggunakan enjin carian web bagi tujuan pengajaran dan pemudahcaraan (PdPc).				√
9.	I can use media devices to present information to the students. Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid				√
10.	I find it is easy to find a website I visited before. Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.				√
11.	I can use media devices such as laptop, handphone, computer as teaching aids (BBM/ABM) for Physical Education subject. Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.				√
12.	When I use the internet to research a topic related to physical education, I feel extremely motivated. Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.				√
13.	I can use different sources of information such as Google/You Tube/ Yahoo! for Physical Education subject. Saya boleh menggunakan pelbagai sumber informasi seperti Google/You Tube/Yahoo! untuk subjek Pendidikan Jasmani.				√

14.	I can use media devices to communicate with students. Saya dapat menggunakan pelbagai peranti media untuk berkomunikasi dengan murid.				√
15.	I can create media content by using PowerPoint/ Microsoft Word /Google Meet for Physical Education subjects. Saya dapat menghasilkan bahan media menggunakan Power Point/ Microsoft Word/Google Meet untuk subjek Pendidikan Jasmani.				√
16.	Through online media platforms, I share the personal media that I create, such as digital art with my students. Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian				√
17.	I collectively with other physical education teachers build digital instructional tools for my students. Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.				√
18.	I am familiar with the rules of the user agreements for websites where I produce. Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.				√
19.	I employ image editing applications to adapt audio-visual material to my online teaching and facilitation (PdPc) purposes. Saya menggunakan aplikasi sunting imej untuk menyesuaikan bahan audio-visual dengan keperluan pengajaran dan pemudahcaraan (PdPc) dalam talian saya.				√
20.	I learn how to use media platform for developing digital educational content by watching online tutorials. Saya belajar cara menggunakan platform media untuk memperoleh kandungan pendidikan digital dengan menonton tutorial dalam talian.				√

21.	I always keep the source of any data I obtain from any platform in my digital devices. Saya sentiasa menyimpan data yang saya dapat daripada pelbagai platform sebagai dokumen dalam peranti digital saya.				√
22.	I can make any changes of information during online teaching for Physical Education subject on my digital devices. Saya boleh membuat sebarang perubahan maklumat semasa pengajaran dalam talian untuk mata pelajaran Pendidikan Jasmani pada peranti digital saya.				√
23.	I have experience using resources that will benefit my online teaching. Saya mempunyai pengalaman menggunakan sumber yang dapat membantu saya untuk pengajaran dalam talian.				√
24.	I am aware of the existence of the educational social networks. Saya sedar dengan kewujudan rangkaian sosial pendidikan.				√
25.	I know how to use emoticons. Saya tahu cara menggunakan emoji.				√
26.	I use digital technologies to communicate in online environments. Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.				√
27.	I can make decision of which media platform to follow online. Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.				√
28.	I am satisfied with my ability to adapt the changes in technology. Saya sangat berpuas hati dengan kebolehan saya untuk menyesuaikan diri dengan perubahan teknologi				√

29.	For teaching materials of physical education, I use information from the internet. Sebagai bahan pengajaran pendidikan jasmani, saya menggunakan informasi daripada internet.				√
30.	I know which information I should share online. Saya tahu maklumat mana yang patut saya kongsi dalam talian.				√
31.	I know how to remove friends from my platform media lists (e.g Tiktok, Instagram, Facebook). Saya tahu cara mengeluarkan rakan daripada senarai platform media saya (e.g Tiktok, Instagram, Facebook).			√	
32.	I can identify the causes of technical problems when using digital devices. Saya dapat mengenal pasti punca masalah teknikal apabila menggunakan peranti digital.				√
33.	I can solve the technical problem I encounter when using digital devices. Saya dapat menyelesaikan masalah teknikal yang saya hadapi apabila menggunakan peranti digital.				√
34.	I can update my anti-virus software on my computer. Saya boleh mengemas kini perisian anti-virus saya pada komputer saya.				√
35.	I am familiar with a variety of media file formats. Saya biasa dengan pelbagai format fail media.				√
36.	I have addressed various technical problems with my digital equipment, through online communication. Saya telah menangani pelbagai isu teknikal dengan peranti digital saya melalui komunikasi dalam talian.				√
37.	I develop my digital competence by always following new developments. Saya meningkatkan kompetensi digital saya dengan sentiasa mengikuti perkembangan baru.				√

38.	I can evaluate the trustworthiness of information found on the internet. Saya dapat menilai kesahihan maklumat yang terdapat di Internet.				√
39.	I am aware of how to overcome for students who are addicted to digital. Saya tahu bagaimana cara untuk mengatasi murid yang ketagihan digital.				√
40.	There is enough cooperation between teachers for ICTs issues. Terdapat kerjasama yang cukup antara guru berkenaan isu teknologi maklumat.				√
41.	I use protection software such as antivirus on all my devices. Saya menggunakan perisian perlindungan seperti antivirus pada semua peranti saya.				√
42.	To avoid physical harm, I keep track of how much time I spend online. Saya mengambil tahu mengenai tempoh masa yang saya luangkan dalam talian untuk mengelakkan kemudaratan fizikal.				√
43.	I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression. Saya sedar tentang risiko kesihatan yang berkaitan dengan penyalahgunaan teknologi seperti obesiti /gangguan penglihatan/kemurungan.				√

Remarks:

Most of the items above are relevant and suitable for studying the ability and skills of
teachers in using digital technology.

Verified by,



Name : **MOHD FAIZUL AZLI BIN ABDUL MUDZAFAR**
Position : **GURU CEMERLANG PJK DG48**
Date : **15 FEBRUARI 2024**

CONTENT EXPERT

Construct Validity of Instrumentation of Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Questions deal with significant topic to create understanding and interest among respondents.				✓
2.	Direction of items are clear and complete.			✓	
3.	No double items in one question.				✓
4.	Items are appropriate to measure all the constructs.				✓
5.	The items are appropriate to respondents.				✓

Remarks:

The items used in questionnaire are suitable and appropriate to respondents.

Verified by,



Name : MOHD FAIZUL AZLI BIN ABDUL MUDZAFAR

Position : GURU CEMERLANG PJK DG48

Date : 15 FEBRUARI 2024

APPENDIX 8

Expert 3

LANGUAGE / CONTENT EXPERT

**Construct Validity of Instrumentation: Malay Version of Digital Skills Questionnaire
Among Physical Education Teachers In Selangor.**

Tick (✓) in the space provided Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz/Kahoot/Wordwall dan lain-lain.				/
2.	Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.			/	
3.	Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.				/
4.	Saya menggunakan laman web untuk membantu pengajaran saya dalam subjek Pendidikan Jasmani.				/
5.	Saya menggunakan komputer untuk tujuan pengajaran dan pemudahcaraan (PdPc) bagi subjek Pendidikan Jasmani.				/
6.	Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.			/	
7.	Saya dapat mencipta dokumen Word asas untuk tujuan pengajaran dan pemudahcaraan (PdPc).				/
8.	Saya dapat mencari maklumat untuk subjek Pendidikan Jasmani menggunakan enjin carian web bagi tujuan pengajaran dan pemudahcaraan (PdPc).				/
9.	Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid.				/
10.	Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.				/
11.	Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.				/
12.	Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.				/
13.	Saya boleh menggunakan pelbagai sumber informasi seperti Google/You Tube/Yahoo! untuk subjek Pendidikan Jasmani.				/

14.	Saya dapat menggunakan pelbagai peranti media untuk berkomunikasi dengan murid.				/
15.	Saya dapat menghasilkan bahan media menggunakan Power Point/ Microsoft Word/Google Meet untuk subjek Pendidikan Jasmani.				/
16.	Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian.			/	
17.	Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.				/
18.	Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.				/
19.	Saya menggunakan aplikasi sunting imej untuk menyesuaikan bahan audio-visual dengan keperluan pengajaran dan pemudahcaraan (PdPc) dalam talian saya.				/
20.	Saya belajar cara menggunakan platform media untuk memperoleh kandungan pendidikan digital dengan menonton tutorial dalam talian.				/
21.	Saya sentiasa menyimpan data yang saya dapat daripada pelbagai platform sebagai dokumen dalam peranti digital saya.				/
22.	Saya boleh membuat sebarang perubahan maklumat semasa pengajaran dalam talian untuk mata pelajaran Pendidikan Jasmani pada peranti digital saya.				/
23.	Saya mempunyai pengalaman menggunakan sumber yang dapat membantu saya untuk pengajaran dalam talian.				/
24.	Saya sedar dengan kewujudan rangkaian sosial pendidikan.				/
25.	Saya tahu cara menggunakan emoji.				/
26.	Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.				/
27.	Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.			/	
28.	Saya sangat berpuas hati dengan kebolehan saya untuk menyesuaikan diri dengan perubahan teknologi.			/	
29.	Sebagai bahan pengajaran pendidikan jasmani, saya menggunakan informasi daripada internet.				/
30.	Saya tahu maklumat mana yang patut saya kongsi dalam talian.				/
31.	Saya tahu cara mengeluarkan rakan daripada senarai platform media saya (e.g Tiktok, Instagram, Facebook).			/	

32.	Saya dapat mengenal pasti punca masalah teknikal apabila menggunakan peranti digital.				/
33.	Saya dapat menyelesaikan masalah teknikal yang saya hadapi apabila menggunakan peranti digital.			/	
34.	Saya boleh mengemas kini perisian anti-virus saya pada komputer saya.				/
35.	Saya biasa dengan pelbagai format fail media.			/	
36.	Saya telah menangani pelbagai isu teknikal dengan peranti digital saya melalui komunikasi dalam talian.				/
37.	Saya meningkatkan kompetensi digital saya dengan sentiasa mengikuti perkembangan baru.				/
38.	Saya dapat menilai kesahihan maklumat yang terdapat di Internet.			/	
39.	Saya tahu bagaimana cara untuk mengatasi murid yang ketagihan digital.				/
40.	Terdapat kerjasama yang cukup antara guru berkenaan isu teknologi maklumat.			/	
41.	Saya menggunakan perisian perlindungan seperti antivirus pada semua peranti saya.				/
42.	Saya mengambil tahu mengenai tempoh masa yang saya luangkan dalam talian untuk mengelakkan kemudaratan fizikal.				/
43.	Saya sedar tentang risiko kesihatan yang berkaitan dengan penyalahgunaan teknologi seperti obesiti /gangguan penglihatan/kemurungan.				/

Remarks:

Pengetahuan kemahiran digital amat penting dan seiring dengan Dasar Pendidikan Kebangsaan ke arah kecemerlangan pendidikan secara global.

Verified by,



Name : M. SHAHARUDDEN M. KALAM
GURU CEMERLANG BAHASA MELAYU
MAKTAB SULTAN ISMAIL
KOTABAHARU, KELANTAN.

Position :

LANGUAGE EXPERT

Construct Validity of Instrumentation: Malay Version of Digital Skills Questionnaire
Among Physical Education Teachers In Selangor.

Tick (✓) in the space provided

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Questions deal with significant topic to create understanding and interest among respondents.				/
2.	Direction of items are clear and complete.				/
3.	No double items in one question.				/
4.	Items are appropriate to measure all the constructs				/
5.	The items are appropriate to respondents.				/

Remarks:

*Bahan dan soalan yang digunakan
dalam kaji selidik ini amat berseesuaian
dengan kajian yang dibuat. Tahniat!*

Verified by,

Sh

Name : M.SHAHARUDDEN M.KALAM
Position : GURU CEMERLANG BAHASA MELAYU
MAKTAB SULTAN ISMAIL
KOTABAHARU, KELANTAN.
Date :

APPENDIX 9

Expert 4

CONTENT EXPERT

Construct Validity of Instrumentation: Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes. Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz/Kahoot/Wordwall dan lain-lain. Suggestion: Quizizz/Kahoot/Wordwall/alat gamifikasi lain adalah digunakan dalam kelas Pendidikan Jasmani saya.				✓
2.	The online quiz's time allocated is sufficient. Suggestion: The allotted online quiz time is sufficient Masa yang diberikan untuk kuiz dalam talian adalah mencukupi. Suggestion: Masa kuiz dalam talian yang diperuntukkan adalah mencukupi.			✓	
3.	I find it easy to learn something by reading from digital devices. Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital. Suggestion: Saya mendapati mudah untuk mempelajari sesuatu dengan membaca daripada peranti digital.			✓	
4.	I use websites to support my teaching in Physical Education subject. Suggestion: I use the website to support my teaching in Physical Education subjects. Saya menggunakan laman web untuk membantu pengajaran saya dalam subjek Pendidikan Jasmani. Suggestion: Saya menggunakan laman web untuk menyokong pengajaran saya dalam subjek Pendidikan Jasmani.				✓
5.	I use computer for teaching and facilitation (PdPc) purpose for Physical Education subject. Saya menggunakan komputer untuk tujuan pengajaran dan pemudahcaraan (PdPc) bagi subjek Pendidikan Jasmani.				✓
6.	I fairly evaluate each homework that students turn in using the online application. Suggestion: I fairly evaluate each homework submitted by students using the online application				✓

	Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.				
7.	I can create a basic Word Document for my teaching and facilitation (PdPc) purposes. boleh Saya dapat mencipta dokumen Word asas untuk tujuan pengajaran dan pemudahcaraan (PdPc).				✓
8.	I can search information for Physical Education subject using a web search engine for teaching and facilitation (PdPc). boleh Saya dapat mencari maklumat untuk subjek Pendidikan Jasmani menggunakan enjin carian web bagi tujuan untuk pengajaran dan pemudahcaraan (PdPc).				✓
9.	I can use media devices to present information to the students. Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid				✓
10.	I find it is easy to find a website I visited before. rasa Saya berasa mudah untuk mencari laman web yang saya pernah saya lawati sebelum ini.				✓
11.	I can use media devices such as laptop, handphone, computer as teaching aids (BBM/ABM) for Physical Education subject. subjects. Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani. Suggestion: Saya boleh menggunakan peranti media seperti komputer riba, telefon bimbit, komputer sebagai alat bantu mengajar (BBM/ABM) bagi subjek Pendidikan Jasmani.				✓
12.	When I use the internet to research a topic related to physical education, I feel extremely motivated. Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian. Suggestion: Apabila saya menggunakan internet untuk menyelidik topik yang berkaitan dengan pendidikan jasmani, saya berasa sangat bermotivasi.				✓
13.	I can use different ^{various} sources of information such as Google/You Tube/ Yahoo! for Physical Education subject. the subject of Physical Education Saya boleh menggunakan pelbagai sumber informasi seperti Google/You Tube/Yahoo! untuk subjek Pendidikan Jasmani.				✓

14.	I can ^{use various} use media devices to communicate with students. Saya dapat menggunakan pelbagai peranti media untuk berkomunikasi dengan murid.				✓
15.	I can ^{produce} create media ^{materials} content by using PowerPoint/ Microsoft Word /Google Meet for Physical Education subjects. Saya dapat menghasilkan bahan media menggunakan Power Point/ Microsoft Word/Google Meet untuk subjek Pendidikan Jasmani.				✓
16.	Through online media platforms, I share the personal media that I create, such as digital art with my students. Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian Suggestion: Melalui platform media dalam talian, saya berkongsi media peribadi yang saya cipta, seperti seni digital, dengan pelajar saya.				✓
17.	I collectively with other physical education teachers build digital instructional tools for my students. Suggestion: I am collectively building a digital instructional tool for my students with other Physical Education teachers. Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.				✓
18.	I am familiar with the ^{user agreement rules} rules of the user agreements for the websites where I produce. Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.				✓
19.	I ^{use} employ image editing applications to adapt audio-visual ^{materials} material to my online teaching and facilitation (PdPc) purposes. Saya menggunakan aplikasi ^{penyuntingan} sunting -imej untuk menyesuaikan bahan audio-visual dengan ^{keperluan tujuan} keperluan pengajaran dan pemudahcaraan (PdPc) dalam talian saya.				✓
20.	I ^{learn} learn how to use media ^{platforms to develop} platform for developing digital educational content by watching online tutorials. Saya belajar cara menggunakan platform media untuk ^{membangunkan} memperoleh kandungan pendidikan digital dengan menonton tutorial dalam talian.				✓

21.	I always keep the source of any data I obtain from any platform in my digital devices. Suggestion: I always save the data I get from various platforms as documents in my digital device. Saya sentiasa menyimpan data yang saya dapat daripada pelbagai platform sebagai dokumen dalam peranti digital saya.			✓	
22.	I can make any changes of information information changes during online teaching for Physical Education subject on my digital devices. Saya boleh membuat sebarang perubahan maklumat semasa pengajaran dalam talian untuk mata pelajaran Pendidikan Jasmani pada peranti digital saya.			✓	
23.	I have experience using resources that will benefit my can help me for online teaching. Saya mempunyai pengalaman menggunakan sumber yang dapat membantu saya untuk pengajaran dalam talian.				✓
24.	I am aware of the existence of the educational social networks. Saya sedar dengan kewujudan rangkaian sosial pendidikan.				✓
25.	I know how to use emoticons. Saya tahu cara menggunakan emoji emotikon (Sumber dewan bahasa).		✓		
26.	I use digital technologies to communicate in online environments. Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.				✓
27.	I can make decision of decide which media platform to follow online. to be online Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.				✓
28.	I am satisfied very satisfied with my ability to adapt the changes to changing in technology. Saya sangat berpuas hati dengan kebolehan saya untuk menyesuaikan diri dengan perubahan teknologi				✓

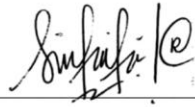
29.	For teaching materials of physical education, I use information from the internet. Untuk Sebagai bahan pengajaran pendidikan jasmani, saya menggunakan informasi maklumat daripada internet.				✓
30.	I know which information I should share online. Saya tahu maklumat mana yang patut saya kongsi dalam talian.				✓
31.	I know how to remove friends from my platform media lists (e.g Tiktok, Instagram, Facebook). Saya tahu cara mengeluarkan rakan daripada senarai platform media saya (e.g Tiktok, Instagram, Facebook).			✓	
32.	I can identify the causes of technical problems when using digital devices. Saya dapat mengenal pasti punca masalah teknikal apabila menggunakan peranti digital.				✓
33.	I can solve the technical problem I encounter when using digital devices. Saya dapat menyelesaikan masalah teknikal yang saya hadapi apabila menggunakan peranti digital.				✓
34.	I can update my anti-virus software on my computer. Saya boleh mengemas kini perisian anti-virus saya pada komputer saya.				✓
35.	I am familiar with a variety of media file formats. Saya biasa dengan pelbagai format fail media.				✓
36.	I have addressed various technical problems with my digital equipment, through online communication. Saya telah menangani pelbagai isu teknikal dengan peranti peralatan digital saya melalui komunikasi dalam talian.				✓
37.	I develop my digital competence by always following new developments. Saya meningkatkan kompetensi digital saya dengan sentiasa mengikuti perkembangan baru.				✓

38.	I can evaluate the trustworthiness of information found on the internet. Saya dapat ^{boleh} menilai kesahihan maklumat yang terdapat di Internet.				✓
39.	I am aware of ^{know} how to overcome ^{deal with} students who are addicted to digital ^{digitally addicted} . Saya tahu bagaimana cara untuk mengatasi murid yang ketagihan digital.				✓
40.	There is enough cooperation between teachers for ICTs issues ^{regarding information technology issues} . Terdapat kerjasama yang cukup antara guru berkenaan isu teknologi maklumat.				✓
41.	I use protection software such as ^{like} antivirus on all my devices. Saya menggunakan perisian perlindungan seperti antivirus pada semua peranti saya.				✓
42.	To avoid physical harm, I keep track of how much time I spend online. Suggestion: I am mindful of the amount of time I spend online to avoid physical harm. Saya mengambil tahu mengenai tempoh masa yang saya luangkan dalam talian untuk mengelakkan kemudaratan fizikal.				✓
43.	I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression. Suggestion: I am aware of the health risks associated with technology abuse such as obesity/vision impairment/depression. Saya sedar tentang risiko kesihatan yang berkaitan dengan penyalahgunaan teknologi seperti obesiti /gangguan penglihatan/kemurungan.				✓

Remarks:

There is a difference in meaning between English and Malay in the survey question. Kindly refer to the suggestions above

Verified by,



Name : Ts. Dr. Anis Farihan Binti Mat Raffei
Ketua Teknikal
Position : Pusat Sumber Pengajaran & e-Pembelajaran (PSPe)
Jabatan Hal Ehwal Akademik dan Antarabangsa
Date : Universiti Malaysia Pahang Al-Sultan Abdullah
9/1/2024

CONTENT EXPERT

Construct Validity of Instrumentation of Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

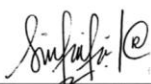
Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Questions deal with significant topic to create understanding and interest among respondents.				✓
2.	Direction of items are clear and complete.			✓	
3.	No double items in one question.				✓
4.	Items are appropriate to measure all the constructs.				✓
5.	The items are appropriate to respondents.				✓

Remarks:

Verified by,



Name : Ts. Dr. Anis Farihan Binti Mat Raffei
Ketua Teknikal
Pusat Sumber Pengajaran & e-Pembelajaran (PSPe)
Position : Jabatan Hal Ehwal Akademik dan Antarabangsa
Universiti Malaysia Pahang Al-Sultan Abdullah
Date : 9/1/2024

APPENDIX 10

Expert 5

CONTENT EXPERT

Construct Validity of Instrumentation: Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes. Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz/Kahoot/Wordwall dan lain-lain.				✓
2.	The online quiz's time allocated is sufficient. Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.			✓	
3.	I find it easy to learn something by reading from digital devices. Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.			✓	
4.	I use websites to support my teaching in Physical Education subject. Saya menggunakan laman web untuk membantu pengajaran saya dalam subjek Pendidikan Jasmani.				✓
5.	I use computer for teaching and facilitation (PdPc) purpose for Physical Education subject. Saya menggunakan komputer untuk tujuan pengajaran dan pemudahcaraan (PdPc) bagi subjek Pendidikan Jasmani.				✓
6.	I fairly evaluate each homework that students turn in using the online application.				✓

	Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.				
7.	I can create a basic Word Document for my teaching and facilitation (PdPc) purposes. Saya dapat mencipta dokumen Word asas untuk tujuan pengajaran dan pemudahcaraan (PdPc).				✓
8.	I can search information for Physical Education subject using a web search engine for teaching and facilitation (PdPc). Saya dapat mencari maklumat untuk subjek Pendidikan Jasmani menggunakan enjin carian web bagi tujuan pengajaran dan pemudahcaraan (PdPc).				✓
9.	I can use media devices to present information to the students. Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid				✓
10.	I find it is easy to find a website I visited before. Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.			✓	
11.	I can use media devices such as laptop, handphone, computer as teaching aids (BBM/ABM) for Physical Education subject. Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.				✓
12.	When I use the internet to research a topic related to physical education, I feel extremely motivated. Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.				✓
13.	I can use different sources of information such as Google/You Tube/ Yahoo! for Physical Education subject. Saya boleh menggunakan pelbagai sumber informasi seperti Google/You Tube/Yahoo! untuk subjek Pendidikan Jasmani.				✓

14.	I can use media devices to communicate with students. Saya dapat menggunakan pelbagai peranti media untuk berkomunikasi dengan murid.				✓
15.	I can create media content by using PowerPoint/ Microsoft Word /Google Meet for Physical Education subjects. Saya dapat menghasilkan bahan media menggunakan Power Point/ Microsoft Word/Google Meet untuk subjek Pendidikan Jasmani.				✓
16.	Through online media platforms, I share the personal media that I create, such as digital art with my students. Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian				✓
17.	I collectively with other physical education teachers build digital instructional tools for my students. Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.				✓
18.	I am familiar with the rules of the user agreements for websites where I produce. Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.				✓
19.	I employ image editing applications to adapt audio-visual material to my online teaching and facilitation (PdPc) purposes. Saya menggunakan aplikasi sunting imej untuk menyesuaikan bahan audio-visual dengan keperluan pengajaran dan pemudahcaraan (PdPc) dalam talian saya.			✓	
20.	I learn how to use media platform for developing digital educational content by watching online tutorials. Saya belajar cara menggunakan platform media untuk memperoleh kandungan pendidikan digital dengan menonton tutorial dalam talian.				✓

21.	I always keep the source of any data I obtain from any platform in my digital devices. Saya sentiasa menyimpan data yang saya dapat daripada pelbagai platform sebagai dokumen dalam peranti digital saya.			✓	
22.	I can make any changes of information during online teaching for Physical Education subject on my digital devices. Saya boleh membuat sebarang perubahan maklumat semasa pengajaran dalam talian untuk mata pelajaran Pendidikan Jasmani pada peranti digital saya.				✓
23.	I have experience using resources that will benefit my online teaching. Saya mempunyai pengalaman menggunakan sumber yang dapat membantu saya untuk pengajaran dalam talian.				✓
24.	I am aware of the existence of the educational social networks. Saya sedar dengan kewujudan rangkaian sosial pendidikan.				✓
25.	I know how to use emoticons. Saya tahu cara menggunakan emoji.		✓		
26.	I use digital technologies to communicate in online environments. Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.				✓
27.	I can make decision of which media platform to follow online. Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.				✓
28.	I am satisfied with my ability to adapt the changes in technology. Saya sangat berpuas hati dengan kebolehan saya untuk menyesuaikan diri dengan perubahan teknologi				✓

29.	For teaching materials of physical education, I use information from the internet. Sebagai bahan pengajaran pendidikan jasmani, saya menggunakan informasi daripada internet.				✓
30.	I know which information I should share online. Saya tahu maklumat mana yang patut saya kongsi dalam talian.				✓
31.	I know how to remove friends from my platform media lists (e.g Tiktok, Instagram, Facebook). Saya tahu cara mengeluarkan rakan daripada senarai platform media saya (e.g Tiktok, Instagram, Facebook).			✓	
32.	I can identify the causes of technical problems when using digital devices. Saya dapat mengenal pasti punca masalah teknikal apabila menggunakan peranti digital.				✓
33.	I can solve the technical problem I encounter when using digital devices. Saya dapat menyelesaikan masalah teknikal yang saya hadapi apabila menggunakan peranti digital.				✓
34.	I can update my anti-virus software on my computer. Saya boleh mengemas kini perisian anti-virus saya pada komputer saya.			✓	
35.	I am familiar with a variety of media file formats. Saya biasa dengan pelbagai format fail media.				✓
36.	I have addressed various technical problems with my digital equipment, through online communication. Saya telah menangani pelbagai isu teknikal dengan peranti digital saya melalui komunikasi dalam talian.				✓
37.	I develop my digital competence by always following new developments. Saya meningkatkan kompetensi digital saya dengan sentiasa mengikuti perkembangan baru.				✓

38.	I can evaluate the trustworthiness of information found on the internet. Saya dapat menilai kesahihan maklumat yang terdapat di Internet.				✓
39.	I am aware of how to overcome for students who are addicted to digital. Saya tahu bagaimana cara untuk mengatasi murid yang ketagihan digital.				✓
40.	There is enough cooperation between teachers for ICTs issues. Terdapat kerjasama yang cukup antara guru berkenaan isu teknologi maklumat.				✓
41.	I use protection software such as antivirus on all my devices. Saya menggunakan perisian perlindungan seperti antivirus pada semua peranti saya.				✓
42.	To avoid physical harm, I keep track of how much time I spend online. Saya mengambil tahu mengenai tempoh masa yang saya luangkan dalam talian untuk mengelakkan kemudaratan fizikal.				✓
43.	I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression. Saya sedar tentang risiko kesihatan yang berkaitan dengan penyalahgunaan teknologi seperti obesiti /gangguan penglihatan/kemurungan.				✓

Remarks:

The sentences are direct and easy to understand. However, maybe the questions could be categorised under personal habit or professional usage of digital skills.

Verified by,


Name : Dr. Mazlin Mohamed Mokhtar
Penyarah Kanan
Position : Jabatan Bahasa dan Kesasteraan Inggeris
Fakulti Bahasa dan Komunikasi
Universiti Pendidikan Sultan Idris
Date : 21/1/2024

CONTENT EXPERT

Construct Validity of Instrumentation of Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Questions deal with significant topic to create understanding and interest among respondents.				✓
2.	Direction of items are clear and complete.			✓	
3.	No double items in one question.				✓
4.	Items are appropriate to measure all the constructs.			✓	
5.	The items are appropriate to respondents.				✓

Remarks:

The questions are relevant depending on the research focus - is it focussing on what the teachers practice in daily life that impact their teaching skills OR whether the teachers are skillful enough to use digital devices/internet/applications/etc. in the classrooms.

Verified by,

Name : Dr. Mazlin Mohamed Mokhtar
Pensyarah Kanan
Jabatan Bahasa dan Komunikasi
Fakulti Bahasa dan Komunikasi
Position : Universiti Pendidikan Sultan Idris
Date : 21/1/2024

APPENDIX 11

Expert 6

CONTENT EXPERT

Construct Validity of Instrumentation: Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

Indicator:

1	2	3	4
Item is not relevant	Item somewhat relevant	Item quite relevant	Item highly relevant

	Checklist	1	2	3	4
1.	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes. Gamifikasi yang saya gunakan di dalam kelas untuk subjek Pendidikan Jasmani ialah Quizizz/Kahoot/Wordwall dan lain-lain.				
2.	The online quiz's time allocated is sufficient. Masa yang diberikan untuk kuiz dalam talian adalah mencukupi.				
3.	I find it easy to learn something by reading from digital devices. Saya mendapati amat mudah untuk mempelajari sesuatu dengan menggunakan peranti digital.				
4.	I use websites to support my teaching in Physical Education subject. Saya menggunakan laman web untuk membantu pengajaran saya dalam subjek Pendidikan Jasmani.				
5.	I use computer for teaching and facilitation (PdPc) purpose for Physical Education subject. Saya menggunakan komputer untuk tujuan pengajaran dan pemudahcaraan (PdPc) bagi subjek Pendidikan Jasmani.				
6.	I fairly evaluate each homework that students turn in using the online application.				

	Saya menilai secara adil setiap tugas yang diserahkan oleh murid melalui aplikasi dalam talian.				
7.	I can create a basic Word Document for my teaching and facilitation (PdPc) purposes. Saya dapat mencipta dokumen Word asas untuk tujuan pengajaran dan pemudahcaraan (PdPc).				
8.	I can search information for Physical Education subject using a web search engine for teaching and facilitation (PdPc). Saya dapat mencari maklumat untuk subjek Pendidikan Jasmani menggunakan enjin carian web bagi tujuan pengajaran dan pemudahcaraan (PdPc).				
9.	I can use media devices to present information to the students. Saya dapat menggunakan peranti media untuk memberikan maklumat kepada murid				
10.	I find it is easy to find a website I visited before. Saya berasa mudah untuk mencari laman web yang saya lawati sebelum ini.				
11.	I can use media devices such as laptop, handphone, computer as teaching aids (BBM/ABM) for Physical Education subject. Saya dapat menggunakan peranti media sebagai bahan bantuan mengajar (BBM/ABM) untuk subjek Pendidikan Jasmani.				
12.	When I use the internet to research a topic related to physical education, I feel extremely motivated. Saya lebih bermotivasi semasa mencari maklumat berkaitan dengan topik Pendidikan Jasmani secara dalam talian.				
13.	I can use different sources of information such as Google/You Tube/ Yahoo! for Physical Education subject. Saya boleh menggunakan pelbagai sumber informasi seperti Google/You Tube/Yahoo! untuk subjek Pendidikan Jasmani.				

14.	I can use media devices to communicate with students. Saya dapat menggunakan pelbagai peranti media untuk berkomunikasi dengan murid.				
15.	I can create media content by using PowerPoint/ Microsoft Word /Google Meet for Physical Education subjects. Saya dapat menghasilkan bahan media menggunakan Power Point/ Microsoft Word/Google Meet untuk subjek Pendidikan Jasmani.				
16.	Through online media platforms, I share the personal media that I create, such as digital art with my students. Saya berkongsi media peribadi yang saya cipta, seperti seni digital dengan pelajar saya, melalui platform media dalam talian				
17.	I collectively with other physical education teachers build digital instructional tools for my students. Saya secara kolektif membina alat instruksional digital untuk pelajar saya bersama guru Pendidikan Jasmani yang lain.				
18.	I am familiar with the rules of the user agreements for websites where I produce. Saya mahir dengan peraturan perjanjian pengguna untuk laman web yang saya hasilkan.				
19.	I employ image editing applications to adapt audio-visual material to my online teaching and facilitation (PdPc) purposes. Saya menggunakan aplikasi sunting imej untuk menyesuaikan bahan audio-visual dengan keperluan pengajaran dan pemudahcaraan (PdPc) dalam talian saya.				
20.	I learn how to use media platform for developing digital educational content by watching online tutorials. Saya belajar cara menggunakan platform media untuk memperoleh kandungan pendidikan digital dengan menonton tutorial dalam talian.				

21.	I always keep the source of any data I obtain from any platform in my digital devices. Saya sentiasa menyimpan data yang saya dapat daripada pelbagai platform sebagai dokumen dalam peranti digital saya.				
22.	I can make any changes of information during online teaching for Physical Education subject on my digital devices. Saya boleh membuat sebarang perubahan maklumat semasa pengajaran dalam talian untuk mata pelajaran Pendidikan Jasmani pada peranti digital saya.				
23.	I have experience using resources that will benefit my online teaching. Saya mempunyai pengalaman menggunakan sumber yang dapat membantu saya untuk pengajaran dalam talian.				
24.	I am aware of the existence of the educational social networks. Saya sedar dengan kewujudan rangkaian sosial pendidikan.				
25.	I know how to use emoticons. Saya tahu cara menggunakan emoji.				
26.	I use digital technologies to communicate in online environments. Saya menggunakan teknologi digital untuk berkomunikasi dalam secara atas talian.				
27.	I can make decision of which media platform to follow online. Saya boleh membuat keputusan memilih platform media yang harus diikuti untuk berada dalam talian.				
28.	I am satisfied with my ability to adapt the changes in technology. Saya sangat berpuas hati dengan kebolehan saya untuk menyesuaikan diri dengan perubahan teknologi				

29.	For teaching materials of physical education, I use information from the internet. Sebagai bahan pengajaran pendidikan jasmani, saya menggunakan informasi daripada internet.				
30.	I know which information I should share online. Saya tahu maklumat mana yang patut saya kongsi dalam talian.				
31.	I know how to remove friends from my platform media lists (e.g Tiktok, Instagram, Facebook). Saya tahu cara mengeluarkan rakan daripada senarai platform media saya (e.g Tiktok, Instagram, Facebook).				
32.	I can identify the causes of technical problems when using digital devices. Saya dapat mengenal pasti punca masalah teknikal apabila menggunakan peranti digital.				
33.	I can solve the technical problem I encounter when using digital devices. Saya dapat menyelesaikan masalah teknikal yang saya hadapi apabila menggunakan peranti digital.				
34.	I can update my anti-virus software on my computer. Saya boleh mengemas kini perisian anti-virus saya pada komputer saya.				
35.	I am familiar with a variety of media file formats. Saya biasa dengan pelbagai format fail media.				
36.	I have addressed various technical problems with my digital equipment, through online communication. Saya telah menangani pelbagai isu teknikal dengan peranti digital saya melalui komunikasi dalam talian.				
37.	I develop my digital competence by always following new developments. Saya meningkatkan kompetensi digital saya dengan sentiasa mengikuti perkembangan baru.				

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40.	There is enough cooperation between teachers for ICTs issues. Terdapat kerjasama yang cukup antara guru berkenaan isu teknologi maklumat.				
41.	I use protection software such as antivirus on all my devices. Saya menggunakan perisian perlindungan seperti antivirus pada semua peranti saya.				
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Remarks:

I prefer that you may change the font style for english text, such like make it Italic so that it can be differentiate between malay and english translation.

I have commented at the comment section, any questions please email to me. tq

Verified by,



Dr. Erni Marlina Saari
Pensyarah
Fakulti Komputeran dan Meta-Teknologi
Universiti Pendidikan Sultan Idris
35900 Tanjong Malim, Perak

Name : Dr. Erni Marlina Saari
Position : Senior Lecturer
Date : 8 January 2024

CONTENT EXPERT

Construct Validity of Instrumentation of Digital Skills Questionnaire Among Physical Education Teachers in Selangor.

Tick (✓) in the space provided.

Indicator:

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2.	Direction of items are clear and complete.				/
3.	No double items in one question.				/
4.	Items are appropriate to measure all the constructs.			/	
5.	The items are appropriate to respondents.				/

Remarks:

The checklist given are relevant with the topic of the study.

Verified by,



Dr. Erni Marlina Saari
Pensyarah
Fakulti Komputeran dan Meta-Teknologi
Universiti Pendidikan Sultan Idris
35900 Tanjong Malim, Perak

Name : Dr. Erni Marlina Saari

Position : Senior Lecturer

Date : 8 January 2024

APPENDIX 12

Certification of Proofread



The Proofreaders' Company
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6th November 2025
To whom this may concern
SIR/MADAM,

CERTIFICATION OF PROOFREADING

Regarding the matter above, we verify that the article mentioned below has been proofread and edited by an editor with a Postgraduate Degree in English with the English level of C2 (Cambridge English Placement Test). The document has also been checked for grammar and structural consistency. Necessary corrections have been made to ensure language accuracy and content fluency.

2. The details of the manuscript are as follow,

Title: THE DEVELOPMENT OF DIGITAL SKILL QUESTIONNAIRE AMONG
PHYSICAL EDUCATION TEACHERS IN SELANGOR

Author: HASNIDA HANIM BINTI AHMAD KAMIL

3. Any questions/inquiries can be forwarded by contacting the editor using the phone number 016-6400661 or email at anassalleh1605@gmail.com

Yours Sincerely

(SHEELA ANASTASIA SALLEH)
B.Ed (TESL), QUT, Aus.
M.Ed (TESL), UMS, Mal,
Editor,
The Proofreader Company

AUTHOR'S PROFILE



Hasnida Hanim binti Ahmad Kamil completed her Master in PE at the Faculty of Education, Universiti Teknologi MARA. She received her MSc in Development of Digital Skills Questionnaire Among PE Teachers in Selangor at the Faculty of Education Universiti Teknologi MARA.