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VALIDATION OF SUBSCALES OF THE DIGITAL SKILLS QUESTIONNAIRE FOR PHYSICAL EDUCATION TEACHER USING EXPLORATORY FACTOR ANALYSIS (EFA)

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Abstract

The rapid integration of digital technologies in education has transformed teaching practices, necessitating the development of valid and reliable tools to assess teachers' digital competencies. This study aimed to develop and validate a Digital Skills Questionnaire tailored for Physical Education (PE) teachers in Selangor, Malaysia. Using a cross-sectional research design, data were collected from 102 randomly selected PE teachers. The instrument development process was guided by established frameworks, including DigComp 2.1, the Digital Strategy for Schools 2015-2020, and the Malaysian Qualifications Framework, ensuring contextual relevance. Exploratory Factor Analysis (EFA) revealed six constructs—information and data literacy, digital content creation, security, problem-solving, teaching, learning and assessment, and communication and collaboration—accounting for 57.99% of the variance. The instrument demonstrated strong internal consistency, with Cronbach's alpha values ranging from 0.796 to 0.935. This study addresses the gap in assessing digital competencies among PE teachers and offers a robust tool for evaluating and enhancing their digital skills, which are critical for fostering innovative and effective teaching practices. Future research should consider adapting the instrument for diverse populations and conducting confirmatory factor analysis (CFA) to further validate the scale.

Keywords: Digital Skills, Physical Education, Digitalization, Validity, Reliability

INTRODUCTION

Technologies, digital tools, and platforms such as video, mobile devices, educational apps, and learning software have been used in classroom recently to facilitate teaching and learning. However, Colomer Rubio (2017) indicated that technologies, especially television and cinema, have been used since 1950. In the 21st century, digitalization is changing the ways individuals work, interact, and learn. Technology has advanced substantially, transforming numerous areas worldwide, including education. The use of digital technologies in education is becoming more prevalent today. Learning environments have shifted from physical to blended environments. Students nowadays also become digital natives (Kesharwani, 2020), digital generation (Yang et al., 2021), and net generation (Tapscott, 1998). Utilizing digital tools like pictures, audio, video, and animation can make teaching more engaging and suitable for students (Omar et al., 2021; Osterlie, 2018). Besides that, technology may promote critical thinking and communication skill (Rayner & Keong, 2020; Barron, 2002). Malaysia has incorporated technology into the education sector due to advancements and changes. The E-learning program was initiated in 1998 through a pilot project named Smart School (Kamaruddin, 2015) and fully implemented in 2013 (Cheok et al., 2017). Meanwhile, The Frog Virtual Learning Environment (VLE) was implemented in 2014 to facilitate teaching and learning. The platform offers diverse multimedia resources and communication tools that educators and students can utilize effectively (Ebrahimi & Kee Jiar, 2018; Berns et al., 2013). However, teachers and students may experience more challenges during teaching and learning activities due to lack of digital skills. For example, ensuring a smoothly teaching and learning process requires both teacher and student posse’s digital skill to connect technologies and theories of learning (Bates, 2005).

Physical Education (PE) is a core subject in the Malaysian curriculum and focuses on movement, sports, recreation, athletics, and fitness. Usually, it occurs outside. Hence, the using of technology should serve the subject's purpose. There are mixed reviews on technology's use in PE. Among the issues has been revealed such as teachers' lack of time to prepare materials, a shortage of relevant sources, a less of digital skills, difficulty in addressing technical issues, not being prepared to integrate technology into the classroom, and a lack of confidence and pedagogical support (Gutierrez et al., 2023; Muniandy et al., 2022). Sargent and Calderon (2021) found that due to their limited digital skills, PE teachers only utilize technology to aid in teaching rather than wholly embracing digital tools to transform their approach to teaching. PE teachers may have difficulty incorporating technology into their lessons, including using digital tools and finding resources. Hence, the related issues might lead to less confidence and difficulty in solving technical issues and finding relevant resources. Revuelta-Domínguez et al., (2022) indicated, assessing teachers' technology proficiency is crucial to ensure the successful integration of technology in the classroom. This is especially important in physical education as identifying areas of strength and weakness can greatly enhance implementation strategies to improve the teacher's ability. In line with De la Calle et al. (2021) asserted that is essential to provide training for teachers to ensure they are ready to integrate technology in classroom. It is imperative to understand that inadequate training for teachers can hinder technology integration into their teaching methods, thereby stalling educational progress (Lohmann et al., 2021; Goktas et al., 2013).

Valid and reliable instruments are essential for accurately assessing teacher competencies. Identifying teacher competencies, particularly digital skills, requires the development of context-specific measurement tools. Despite the availability of several instruments to evaluate digital skills among teachers, instruments tailored specifically to assess digital skills of PE teachers are limited. Existing instruments, such as those developed by Niyazova et al. (2023), Tzaflkou et al. (2023), Gumuş and Kukul (2022), Lucas et al. (2021), and Alarcon et al. (2020), predominantly focus on general or pre-service teachers and utilize varied digital competency frameworks. However, these instruments do not sufficiently address the unique needs and contexts of PE teachers, particularly in Malaysia. Additionally, the development of measurement tools should account for the specific characteristics of the target population. As Switzer et al. (1999) assert, the suitability of an instrument is directly tied to the population for which it is designed. Instruments valid for one population may not be valid for another, as highlighted by Baumgartner (2003), Morrow et al. (2022), and Kane (2015).

Moreover, an instrument validated for one specific purpose may not necessarily be valid for other objectives (Kane, 2015). This underscores the necessity of a thorough validation process to ensure the accuracy and reliability of the data, ultimately leading to precise conclusions. Given these gaps, the present study aims to develop and validate a Digital Skills Questionnaire specifically for PE teachers in Selangor, Malaysia. Establishing construct validity and reliability is critical to ensure the instrument accurately reflects the digital competencies required in this unique educational context. Furthermore, designing robust measurement tools that highlight digital skill deficiencies and profiles among teachers will significantly contribute to enhancing their digital competencies, aligning with contemporary educational needs and frameworks. Digital skills have been known as one of the vital competences due to the rapid integration of ICT in daily human life. Digital skills for teachers refer to using digital technologies for searching, evaluating, and using educational material on the Internet (Tsankov & Damyanov, 2017). Another definition indicates that digital skills are teachers' ability to use and effectively integrate digital technologies into their teaching and learning practices (Tzafilkou et al., 2023). However, the terms teachers' ICT competence, ICT skills, digital competence, digital literacy, digital pedagogy, and digital pedagogical skills are typically used as synonyms to explain teachers' digital skills. In conclusion, digital skills for a teacher are about the ability to use and integrate ICT in daily work to achieve the aim of education with quality outcomes. According to the literature reviews, there are a few digital frameworks used by scholars to determine the skills of digital among teachers, for example, the Digital Competences Framework (DigComp. 2.1) by the European Commission, TPACK framework by Mishra & Koehler (2006), UNESCO ICT Competency Framework for Teachers (UNESCO, 2018), Digital Strategy for School 2015-2020. However, the frameworks provided different indicators to define digital competences for teachers. DigComp. 2.1 describe 5 indicators to explain digital skills for teacher such as information and data literacy, communication and collaboration, digital content creation, problem solving and security dimensions. ISTE Educator Standards consist of 7domains such as curriculum and assessment, pedagogy, application of digital skills, organization and administration, and teacher professional learning. Meanwhile, TPACK framework consists of content knowledge, pedagogical knowledge, technological knowledge, Pedagogical Content Knowledge, and technological content knowledge. Digital Strategy for School 2015-2020 provided 4 key themes such as teaching, learning and assessment using teacher professional learning leadership, research and policy, and ICT infrastructure. According to these reports and frameworks, teachers should have digital skills and constantly improve themselves in information and data literacy, communication and collaboration, digital content creation, safety, problem-solving, and similar competencies.

Despite that, all the frameworks have similar indicators to explain digital skills for teachers. Most of the previous studies used DigComp. 2.1 to explain digital skills for teachers. However, to ensure an in-depth definition of digital skills among PE teachers in Malaysia, the indicator of teaching, learning and assessment and using digital skills ethically and responsibly. The two dimensions are excluded from DigComp. 2.1 should be considered to explain the digitals skills among PE teachers because the term teaching, learning and assessment are fundamental due to the integration of technology in teaching activities. The meaningful embedded technology in the classroom is to transform interactive teaching activities in line with the requirement of the subject. Technology not only becomes teaching aids but ensures classrooms become interactive, creative, and meaningful to the student to acquire skills and knowledge. Besides, the ethical and responsible user is also vital to allow users to develop appropriate behaviour, especially in social networks, able to identify genuine information and be responsible for all the materials created by them. Therefore, the instrument for PE teachers in Selangor, Malaysia, will include seven dimensions of digital skills information and data literacy, communication and collaboration, digital content creation, problem-solving, security teaching, learning and assessment and using digital skills ethically and responsibly dimensions which is a combination of Dig Comp. 2.1, Digital Strategy for School 2015-2020, and Malaysian Qualification Framework (MQF).

MATERIALS AND METHOD

Participants

The study aims to establish construct validity and reliability Digital Skill Instrument for PE Teachers in Selangor, Malaysia, so the study groups consist of PE teachers in Selangor. The participants were selected by using simple random among PE Teachers. 102 participants (Male = 44, Female = 58), was collected. The sample size of EFA is crucial to have a precise impact on statistical analysis, including EFA. Two approaches have been taken to determine the appropriate sample size to perform EFA: setting a minimum total sample size or analyzing the ratio of subjects to variables. However, most scholars agreed that the number of samples should be suggested sampling at least 100 (Kline, 2015; Hair, 2010). Table 1 illustrates the participants' demographics and relevant characteristics for of the respondents.

Table 1: Respondents Characteristics

(N=102) School /Category	Frequency (n)	Percentage (%)
Urban	49	47.6
Rural	53	51.5
Male	44	42.7
Female	58	56.3
Age		
21-30 Years Old	18	17.5
31-40 Years Old	39	37.9
41-50 Years Old	38	36.9
51 Years Old and Above	7	6.8
Experience in Teaching PE		
5 Years and Below	37	35.9
6-10 Years	16	15.5
11-20 Years	37	35.9
21 Years and Above	12	11.7

Research Design

This study employed a cross-sectional research design to collect data from PE teachers in Selangor, Malaysia. Participants were selected through simple random sampling. The Digital Skills instrument was developed systematically, following established procedures.

Procedure for Instrument Development

Developing an instrument to measure digital skills for PE teachers will be based on a procedure proposed by scholars. According to McCoaach et al. (2013), there are ten steps to develop the instrument; (1) Specify the Purpose of the Instrument. (2) Confirm that No Existing Instruments Will Adequately Serve Your Purpose (3) Describe the Constructs and Provide Preliminary Conceptual Definitions. (4) Specify the Dimensions (Facets) of the Construct. (5) Develop Final Conceptual Definitions for Each Dimension Based on a Thorough Literature Review. (6) Develop Operational Definitions. (7) Select a Scaling Technique to Match Items Back to the Dimensions/Constructs, (8) Ensuring Adequate Content Representation on Each Dimension (9) Conduct a Judgmental Review of Items and Develop Directions for Responding; (10) Create a Final Version of Survey (Including Formatting, Demographic Questions, etc.). Meanwhile, Devellis (2016) suggested eight steps to develop an instrument; (1) Determine Clearly What It Is You Want to Measure, (2) Generate an Item Pool, (3) Determine the Format for Measurement, (4) Have an Initial Item Pool Reviewed by Experts (5) Consider Inclusion of Validation Items, (6) Administer Items to a Development Sample (7) Evaluate the Items, and (8) Optimize Scale Length. However, the above process seems to be very systematic and complex due to the many processes. Accordingly, a few scholars (DeVellis, 2016; Clark & Watson, 1995) agreed on the three basic steps for developing the instruments. First, item generation, second, theorical analysis, and the last step is psychometric analysis. Therefore, the present study will combine and simplify the procedure to develop the instrument. The process as explain below:

Item Generation

To perform the first step, researchers conducted literature review and existing scale. Apart from that, a few digital frameworks were identified to examine the suitable factor to asses' digital skills among PE teacher. According to five frameworks such as The Digital Strategy for School, The Malaysian Qualification Framework (MQF), Digital Competence Framework (DIGCOMP) 2.1 were identified as a framework to develop the Digital Skills Instrument for PE Teachers. The Digital Skills Instrument for PE Teachers will use seven constructs identified in previous studies. These constructs are explained using three frameworks. To create the initial items, researchers consider a few factors. DeVellis (2016) suggests that redundant and double-barreled items should be avoided. Additionally, lengthy items are also avoided as they can make things more complicated. Besides, the researchers ensure all the items are clear and precise and use the word or language that is familiar to the target population. All the items are designed to be appropriate for PE teachers' cognition levels. Initially, there are 67 items for this instrument. Table 2 below describes each construct and initial item for the instrument.

Table 2: Constructs, Framework, and Initial Items for Digital Skills Instrument.

Constructs of Digital Skill	Briefly Description	Initial Items
Information and data literacy	Browse, search, evaluate, and manage digital content, data, and information effectively.	1,2,3,4,5,6,7,8,9,10
Digital content creation,	Create digital content, manage copyrights and licenses, and provide programming.	11,12,13,14,15,16,17,18,19
Security	Protecting devices, personal data, health, and environment.	20, 21,22,23,24,25,26,27,28,29,30
Problem solving	Solve all the technical issues, identify needs, technological response, competence gaps, and creative use of technologies.	31, 32,33,34,35,36,37,38,39
Teaching, learning, and assessment	Understanding of the key components' teachers 'digital competence, support innovative teaching and learning, assessment methods.	40, 41, 42,43,44,45,46,47,48,
Using digital skills ethically and responsibly	Verifying information sources and educating students about copyright	49,50, 51, 52, 53,54,55,56,
Communication and collaboration	Interacting, sharing, collaborating through digital technologies, engage citizenship and managing digital identity.	57,58,59,60,61,62,63,64,65,66,67,

Theoretical Analysis

Theoretical Analysis involves evaluating the content validity of the questionnaire. Researchers should assess the content validity of the questionnaire to ensure all the items are precise and reflect the constructs and the purposes of the questionnaire. Content validity is a part of the validity process, which requires experts in the related fields to assess the items. Content validity can be defined as whether the items in the instrument are representative and adequate when attempting to measure constructs. The instrument's items should be reflected in the constructs and target population. Nunnally (1978) indicated that experts in the scale development and constructs of the instruments should be referred by the researcher to ensure the items represent the constructs of the instrument. Besides, ensuring content validity is crucial for construct validity as it offers evidence of how appropriate and accurately the assessment instrument's components reflect the intended construct (Anuar et al., 2023). Usually, to perform content validity, a few experts with at least ten years of experience will review the items to ensure content validity. Thus, the present study selected six experts in the English language (2 experts), PE lectures (2 experts), and ICT lecturers (2 experts) with ten years of experience. The experts will review related to the grammar, format, writing technique, and all the constructs for the instrument. They also will refine the items if necessary.

Psychometric Analysis

The last step is about determine the constructs validity of the instrument. According to Churchill (1979) construct validity is most closely linked to the question of what the instrument is measuring. Moreover, construct validity is about how a scale is used, and it can depend on the situation or population being studied (Kane, 2015; Messick, 1995). This means that it is important to establish the construct validity evidence of the instrument to ensure the data is valuable. Furthermore, construct validity always refers to the context and the population of the study. Aligned with Fabrigar and Wegener (2016), the fact that the scale's psychometric properties were acceptable when developed by previous researchers does not mean that the instrument will have the same properties in a different study or population. Park and Kim (2021) describe statistical analysis using Exploratory Factor study (EFA) and Confirmatory Factor Analysis (CFA) can be used to determine construct validity. Hair (2010) explains that the purpose of EFA is to determine the number of components underlying the element of study. Hence, EFA should be used for the new scale development to determine the factors of the instruments, while CFA was performed to identify the items that fit to model according to the theory of the study (Byrne, 2016). The present study will used EFA to determine the construct validity due to the new scale development that require to determine the number of factors of the instrument and to reduce the number of measure variables. Accordingly, EFA is data-driven since it accepts the results as they are rather than relying on theory or a literature review (Choi &You 2017. Thus, EFA should be used first for the new scale development since CFA is unable to identify the factors' structure, but CFA is vital to verify the EFA results to ensure consistent with the theory or framework of the study (Park & Kim, 2021).

Statistical Analysis

The data obtained from both groups were loaded and analyzed in SPSS 23.00 software to perform validity and reliability analysis of the Digital Skills Instrument for PE Teachers. EFA was used to establish construct validity evidence for the instrument. Using EFA is the best way to define latent variables by exploring relationships among observed variables (Morgado et al., 2017). Thus, it is essential to employ EFA because the previous instrument contains more than five constructs. Using EFA for the present study, the factors can be identified for the measurement. Moreover, Abu Bakar and Su Mustaffa (2013), Bastos et al. (2010), and Ladhari (2010) also agreed that EFA is the most common method to establish construct validity. The statistical analysis relies heavily on the normal distribution assumption. Johnson & Wichern (2019) indicated many multivariate statistical techniques require this assumption to draw valid conclusions. To apply statistical tests or models accurately, the dataset should be either exactly or approximately normally distributed. The present study applied the method of Skewness and Kurtosis. The absolute value of Skewness greater than three and a Kurtosis value greater than ten might indicate a problem (Kline, 2015). Hence, it was suggested that the absolute value of Skewness and Kurtosis should not be greater than 3 and 10.

RESULT

Content Validity

The content validity score will be obtained using (Sidek Mohd. Noah & Ahmad, 2005) formula. Table 3 shows the results of content validity for Digital Skills Instrument.

Table 3: Content Validity according to percentage of experts

Expert/Score	Item 1	Item 2	Item 3	Item 4	Item 5	Score
Expert 1	4	3	5	4	4	0.80
Expert 2	3	3	4	4	5	0.76
Expert 3	4	4	4	4	4	0.80
Expert 4	4	4	4	4	4	0.80
Expert 5	4	3	4	4	4	0.76
Expert 6	3	3	4	4	4	0.72
Total Score						0.92

According to Table 3, obtaining content validity at *r* =.92 is considered good as (Sidek Mohd. Noah & Ahmad, 2005) suggested that a percentage of content validity achievement greater than .70 is considered good.

Normality

The normality test employs skewness and kurtosis. According to the results, all the items in the present study are within the acceptable range of < 3 and < 10 for skewness and kurtosis, as recommended by (Kline, 2015). Table 4 illustrates the result of normality.

Table 4: Results of Normality.

Constructs	Skewness	Kurtosis
Information and data literacy	0.865	4.827
Digital content creation,	0.028	0.082
Security	0.365	-0.068
Problem solving	0.485	-0.189
Teaching, learning, and assessment	-0.651	2.562
Using digital skills ethically and responsibly’	-0.312	1.411
Communication and collaboration	-0.890	2.628

Exploratory Factor Analysis (EFA)

The factor structure of digital skills such as information and data literacy, digital content creation, security, problem-solving, ethical digital skills usage, and communication and collaboration in teaching, learning, and assessment was established through EFA in a study conducted with 102 physical education teachers in Selangor, Malaysia. Prior to conducting EFA, certain conditions were met, as recommended by (Hair et al., 2022) including verifying a KMO score greater than 0.50 and a significant Bartlett's test of sphericity at $p < 0.001$ to ensure the data was appropriate for analysis.

Table 5: Results of KMO and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.745
Bartlett's Test of Sphericity	Approx. Chi-Square	5898.590
	df	2211
	Sig.	.000

The results of Kaiser-Meyer-Olkin (KMO) is 0.745 which is exceed 0.5 and Bartlett's Test of Sphericity was significant ($p < 0.001$) as suggested by Hair et al., (2022). Thus, the data is suitable to perform EFA and the following analysis can be proceeded. A principal component analysis with varimax rotation was used to explore the factor structure of the collected data. The six factors accounted for 57.989% of the total variance which is exceed the minimum requirement 60% (Yahaya et al., 2018; Noor et al., 2015). Six factors had eigenvalues greater than one. Table 6 illustrate the six factors. The explained variance for the first component was 32.41%, for the second, 34.630%, for the third, 50.90%, for the fourth, 54.52%, for the fifth, 57.98%, and for the sixth, 57.989%.

Table 6: Total Variance Explain

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	**% Of Variance**	**Cumulative %**	**Total**	**% Of Variance**	**Cumulative %**
1	21.720	32.418	32.418	21.720	32.418	32.418
2	5.175	7.725	40.143	5.175	7.725	40.143
3	4.274	6.379	46.522	4.274	6.379	46.522
4	2.937	4.383	50.905	2.937	4.383	50.905
5	2.422	3.615	54.520	2.422	3.615	54.520
6	2.324	3.469	57.989	2.324	3.469	57.989

Extraction Method: Principal Component Analysis.

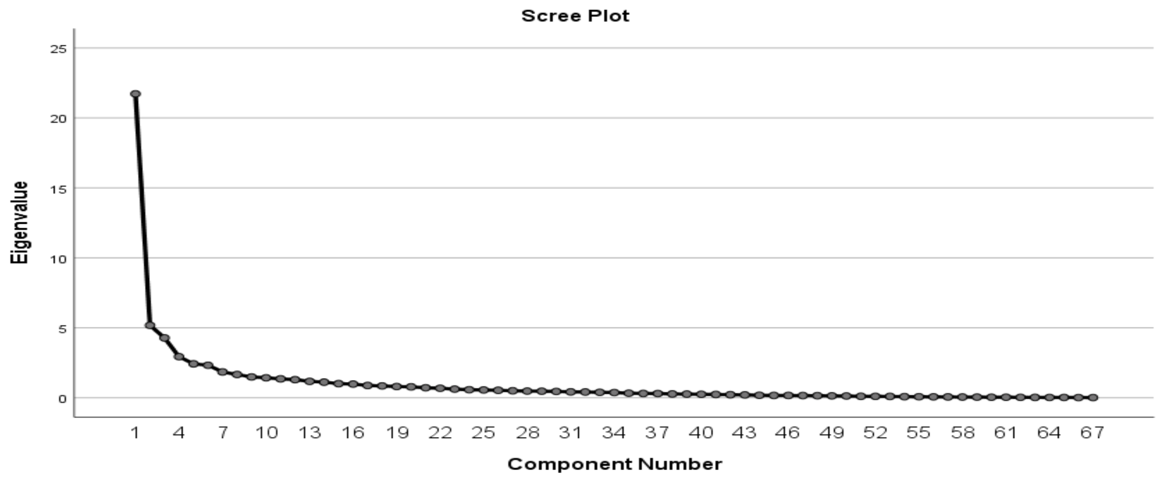

Figure 1: *The Scree Plot extracted six components.*

The eigenvalue approach and scree plot were used to determine the number of factors, as suggested by Watkins (2018), Schumacker and Lomax (2015), Cattell (2012), and Kaiser (1960). The eigenvalue approach suggests that the above 1 value be considered for retained factors. In addition, the researchers have kept any factors above the distinct breaking-down lines in the scree plot. This means that the Digital Skills Instrument for PE Teachers includes six factors and 43 items identified through both approaches even though the researchers decided 6 factors according to literature review and framework at the early phase of questionnaire development. The researchers decided to remain the results of the EFA. This is because the results generated by EFA based on the participants' responses must be considered in the context of the study population, which may differ from other populations in terms of its characteristics. Henson and Roberts (2006) indicated that it is not necessary to keep all factors, significantly, when they don't add to the significance of the items and factors in the overall questionnaire. Table 7 illustrates the factors where all the factor loadings for each factor are greater than 0.5. In this study, the minimum factor loading the cut-off value was 0.5, as suggested by Maskey et al. (2018); items with loadings of 0.5 and above should be included in determining a factor since they are highly significant. In line with Comrey and Lee (2016), the factor loading 0.4 above usually considers the variable as significant. Furthermore, Peterson (2000) explained there is no agreement about a "high" or "low" factor loading. Thus, the remaining items with high factor loading are the best representation of the questionnaire.

Table 7: Component Matrix

	Items	Components 1	2	3	4	5	6
	Teaching, learning & assessment						
1	Quizizz/Kahoot/Wordwall/other gamification tools are used in my Physical Education classes.	.763					
2	The online quiz's time allocated is sufficient.	.669					
3	I find it easy to learn something by reading from digital devices.	.621					
4	I use websites to support my teaching in Physical Education subject.	.604					
5	I use a computer for teaching and facilitation purposes for Physical Education subject.	.596					
6	I fairly evaluate each homework that students turn in using the online application.	.591					
7	I can create a basic Word Document for my teaching and facilitation purposes.	.581					
8	I can search information for Physical Education subject using a web search engine for teaching and facilitation	.569					
	Information and data literacy						
9	I can use media devices to present information to the students.		.794				
10	I find it easy to find a website I visited before.		.787				
11	I can use media devices such as laptops, handphones, and computers as teaching aids (BBM/ABM) for Physical Education subject.		.716				
12	When I use the internet to research a topic related to physical education, I feel extremely motivated.		.690				
13	I can use different sources of information such as Google/YouTube/ Yahoo! for Physical Education subject.		.684				
14	I can use media devices to communicate with students.		.680				
15	I can create media content by using PowerPoint/ Microsoft Word /Google Meet for Physical Education subjects.		.616				
	Creation of digital content						
16	Through online media platforms, I share the personal media that I create, such as digital art with my students.			.808			
17	I collectively with other physical education teachers build digital instructional tools for my students.			.728			
18	I am familiar with the rules of the user agreements for websites where I produce.			.721			
19	I employ image editing applications to adapt audio-visual material to my online teaching and facilitation purposes.			.693			
20	I learn how to use media platforms for developing digital educational content by watching online tutorials.			.675			
21	I always keep the source of any data I obtain from any platform on my digital devices.			.614			
22	I can make any changes to information during online teaching for Physical Education subject on my digital devices.			.585			
23	I have experience using resources that will benefit my online teaching.			.575			
	Communication and collaboration						
24	I am aware of the existence of educational social networks.				.889		

continued

25	I know how to use emoticons.	.871		
26	I use digital technologies to communicate in online environments.	.823		
27	I can make the decision of which media platform to follow online.	.816		
28	I am satisfied with my ability to adapt to the changes in technology.	.795		
29	For teaching materials for physical education, I use information from the internet.	.771		
30	I know which information I should share online.	.748		
31	I know how to remove friends from my platform media lists (e.g., TikTok, Instagram, Facebook).	.734		
	Problem-Solving			
32	I can identify the causes of technical problems when using digital devices.		.781	
33	I can solve the technical problem I encounter when using digital devices.		.756	
34	I can update the anti-virus software on my computer.		.648	
35	I am familiar with a variety of media file formats.		.510	
36	I have addressed various technical problems with my digital equipment, through online communication.		.508	
	Security			
37	I develop my digital competence by always following new developments.			.578
38	I can evaluate the trustworthiness of information found on the internet.			.575
39	I am aware of how to overcome students who are addicted to digital.			.535
40	There is enough cooperation between teachers for ICTs issues.			.505
41	I use protection software such as antivirus on all my devices.			.648
42	To avoid physical harm, I keep track of how much time I spend online.			.547
43	I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression.			.528

The first component, teaching, learning & assessment, has eight items with factor loading ranging from .569 to.763; information and data literacy, seven items, factor loading .616-.794; creation of digital content, eight items, factor loading .575-.808; communication and collaboration, eight items, factor loading, .734-.889; problem-solving, five items, factor loading, .508-.781, and security, seven items, factor loading, .528-.578. The findings also indicated that the factor 'using digital skills ethically and responsibly' was not included. There are three items for factor 'using digital skills ethically and responsibly' at the initial phase such as *I use protection software such as antivirus on all my devices, I am aware of the health risks connected to improper technology use, like obesity/vision problems/depression, to avoid physical harm, I keep track of how much time I spend online* were consider as a factor for security. Therefore, 24 items have been removed because their factor loading was less than 0.5. Some items are referred to as cross-loading. The researcher examined such items and retained only those with a high factor loading.

Internal consistency statistics (Alpha Cronbach) were performed to determine the scale's reliability. Henson (2001) explained internal consistency measures item homogeneity, or how well test items measure the same construct. Meanwhile, Devellis (2016) indicated Alpha Cronbach is the most used method to measure the reliability of the questionnaire. The Cronbach Alpha coefficient was calculated to determine the reliability of the scale. The Cronbach's Alpha value of 43 items was determined as .974. Alpha values .796–.935 were consider excellent (Taber, 2017). Thus, the Digital Skill Questionnaire for PE Teachers is a reliable questionnaire. Table 8 show the results of reliability of Digital Skills Instrument.

Table 8: Reliability of The Digital Skills Questionnaire for PE Teacher

Constructs	Alpha Cronbach	No of Items
Information and data literacy	.914	7
Digital content creation,	.796	8
Security	.935	7
Problem solving	.894	5
Teaching, learning, and assessment	.807	8
Communication and collaboration	.891	8

DISCUSSION

This study aims to establish construct validity and reliability the scale to determine PE teachers' digital skills. The exploratory factor analysis shows that Digital Skills for PE Teachers consist of 6 factors with 43 items. The results show that the final version of Digital Skills for PE Teacher is a scale that enables teachers to determine their skills related to digital. However, the "using digital skills ethically and responsibly" factor was not included in the questionnaire even though the Malaysian Qualification Framework suggested that factor should be consider when measuring digital skills. However, items related to this factor are categorized as a security factor. This is because the items created and identified have similarities with safety factors. Applying ICT ethically and responsibly also refers to safe use. Typically, the practice of ethics and responsibility may improve security in ICT. The misuse of technology comes in many ways such as hacking, disputed right of data, malware, faked and manipulated news or information, intellectual property, too much screen time, cyberbullying, and others. Thus, it is essential to practice ethics and responsibility among users to ensure the security aspect is a priority. Hamburg and Grosch (2017) suggested ethics are very important in cyber security and should be included as an important topic in any curriculum related to ICT. Apart from that, with the wide use of ICT in education, the teacher and students should know the risk of sharing personal information online or clicking unfamiliar links due to cyber threats. Again, the application code of ethics and responsibility are priorities to enhance security. For this reason, it is acceptable to consider the findings of EFA related to ethics, responsibility, and security. There was no evidence that any of the 43 items on the Digital Skills Questionnaire for PE Teachers should be eliminated because Cronbach's alpha of 0.891–.914, is very high internal consistency (Nunnally 1978).

Following the EFA and Cronbach's alpha findings, we believe the questionnaire is an excellent tool to measure the various aspects of PE teachers' digital skills. Subsequently, the questionnaire could be used by teachers for self-evaluation or by schools to evaluate performance, emphasizing areas in which the teacher requires to enhance to meet the purpose of teaching and learning in PE by using technologies. However, the present study's limitation is that the questionnaire is only valid for the target population of PE teachers in either primary or secondary schools in Selangor, Malaysia. Consequently, for the future study, it is suggested to adapt, translate the instrument in other languages according to the target population. By translate this instrument in others language and countries might provide meaningful findings and discussions due to different of cultural, environment, teacher characteristics, and others. Besides, it is recommended that other researchers conduct confirmatory factor analysis (CFA) to test the theory in different populations. The present study was not employed CFA because this instrument is considered a new instrument, and CFA cannot identify the items for the specific factors. In conclusion, the questionnaire is important to assess the level of digital skills among PE teachers in Selangor, Malaysia. Assessing their skills can provide valuable insight for related parties to draw the conclusion and come up with the proper policies and strategies related to technology in physical education subject.

CONCLUSION

This study successfully developed and validated the Digital Skills Questionnaire specifically for Physical Education (PE) teachers in Selangor, Malaysia. Through rigorous procedures including item generation, theoretical analysis, and psychometric testing using Exploratory Factor Analysis (EFA), six valid and reliable subscales were identified: information and data literacy, digital content creation, security, problem-solving, teaching, learning and assessment, and communication and collaboration. These dimensions reflect the essential digital competencies required by PE teachers to effectively integrate technology into their teaching practices.

Although the "using digital skills ethically and responsibly" dimension did not emerge as a distinct factor, its items were absorbed into the security subscale, indicating the close conceptual relationship between ethical digital behavior and digital safety. The instrument demonstrated strong internal consistency, with Cronbach's alpha values ranging from .796 to .935 across the subscales, affirming its reliability. Overall, the Digital Skills Questionnaire offers a valuable tool for self-assessment, institutional audits, and professional development planning related to digital competency among PE teachers.

Future Research Recommendation

Future studies should consider conducting Confirmatory Factor Analysis (CFA) to test the stability and generalizability of the six-factor model across different populations. Researchers are also encouraged to adapt and translate the instrument for use in other languages and educational contexts, enabling cross-cultural validation and comparison. Moreover, integrating the instrument into intervention studies or digital training programs could help evaluate its sensitivity to changes in digital skill levels over time. Expanding the sample to include teachers from other states or countries and exploring associations between digital skills and teaching effectiveness or student learning outcomes would further enhance the instrument's applicability and impact in the field of education.

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