TOWARDS DIGITAL TRANSFORMATION: DEVELOPMENT OF A DIGITAL SKILLS FRAMEWORK FOR PUBLIC OFFICERS

Nor Liyana Mohd Shuib[1] , Nurul Ain Khairul Anwar[1], Nor Atiqah Mohd Shuib[2] and Khairatul Alyani Badari[3]*

[1]Faculty of Computer Science and Information Technology, Universiti Malaya, 50603 Kuala Lumpur, Malaysia

[2]Universiti Utara Malaysia, Sintok, 06010, Bukit Kayu Hitam, Kedah, Malaysia

[3]Faculty of Computing & Multimedia, Universiti Poly-Tech Malaysia, Jalan 6/91, Taman Shamelin Perkasa, 56100 Kuala Lumpur, Malaysia

Emails: liyanashuib@um.edu.my [1*](Corresponding author), u2005370@siswa.um.edu.my[1], atiqahshuib@gmail.com[2,] khairatul_a@uptm.edu.my[3]

ABSTRACT

This study aims to develop a comprehensive Digital Skills Framework for public officers to support Malaysia's digital transformation. Using a quantitative approach, expert validation confirmed the relevance of key components such as digital literacy, communication, problem-solving, and digital security (S-CVI/Ave of 0.94). The framework addresses the need for structured digital skills development to enhance public officers' effectiveness in a digital environment. While limited by its reliance on expert validation, the framework provides practical guidance for designing training programs, improving public service delivery, and supporting the state's digital agenda, contributing to more transparent and efficient governance.

Keywords: Digital Transformation; Digital Skills Framework; Public Officers; Digital Literacy; Digital Competencies.

1.0 INTRODUCTION

Digitalization now plays a crucial role in the public sector in line with the Malaysian government's aspiration to enhance the efficiency and effectiveness of service delivery to its citizens. In today's contemporary landscape, digital transformation stands as the primary driver of innovation and efficiency in the public sector. This transformation is not just a trend but a necessity for modern governance, aiming to improve management practices and service delivery to meet the rising expectations of the public.

As the backbone of effective governance, Malaysian government public officers play a vital role in implementing policies, managing public resources, and ensuring that government services are efficiently delivered to the people. Faced with rapid technological advancements and the growing importance of digitalization, the government is challenged to ensure that its public officers possess the necessary digital skills to adapt, serve, and collaborate effectively in an evolving digital landscape. The level of digital awareness and usage among public officers remains unclear, hindering the development of effective strategies for digital transformation and organizational growth. Many plans have been more focused on technological development, with less emphasis on talent or public officers (UNESCO, 2022). Studies on public service delivery in Malaysia indicate that the digital skills of public officers need to be enhanced to meet the demands of digitalization (Choi & Xavier, 2021). Public officers must continuously upgrade their skills in the face of a challenging and unpredictable operating environment, according to the Minister in the Prime Minister's Department (Economy), Datuk Seri Mustapha Mohamed (Aziz, 2022).

The government has created various opportunities for digital skills training, such as the Digital Government Competency and Capability Readiness (DGCCR) program. However, because individual needs based on job descriptions are not considered, public officers may attend training that is not fully relevant to their job scope. This situation leads to wasted time and costs spent on implementing these training programs. Additionally, many organizations lack comprehensive knowledge and understanding of digital technology, which hinders their ability to assess the benefits of digitalization (Yaacob et al., 2022). This is supported by Mazurchencko and Maršíková (2019), who state that digital transformation in organizations worldwide is being hindered by a lack of appropriate digital skills and inadequate training for employees.

Furthermore, despite the critical need for digital competence, there is a significant gap in a structured framework for assessing and developing these skills among public officers. This gap poses a major obstacle to the

285

effective planning and implementation of training programs tailored to the unique needs of the government. Some past research initiatives have focused on identifying competencies needed for the future workforce, particularly related to digital skills. Flores et al. (2020) developed a competency framework for Human Capital 4.0, emphasizing the importance of integrating digital skills into future human capital. However, their study lacked clear details on the specific dimensions and components required to shape these digital skills. Similarly, a study by van Laar et al. (2019) explored the digital skills needed for 21st-century professionals in communication and design. While their framework is comprehensive, it is specifically tailored to the needs of communication professionals, where digital skill requirements vary by sector and job role. Additionally, Zeiki et al. (2019) pointed out the urgent need for a more inclusive framework to address the diverse needs of digital competence. However, to the best of this study's knowledge, no previous research has focused on digital skills for public officers working in increasingly digital organizations. The absence of a structured framework for identifying and recommending specific digital skills among public officers will hinder efficient public service delivery, smooth interaction with citizens, and limit the government's ability to leverage digital tools for better governance. Therefore, there is an urgent need to develop a structured framework with digital skill components to systematically identify the key digital skills required by public officers and recommend appropriate training, thereby enhancing their digital skills. This framework provides a fundamental understanding of the essential elements needed for successful digital transformation and outlines the critical role of digital skill development in contemporary organizational settings.

2.0 LITERATURE REVIEW

Digital advancement has transformed job roles and work environments worldwide. This transformation is driven by the emergence of digital technologies, including information technology, computing, and communication, which have had both positive and negative impacts in the workplace. Research has consistently highlighted the positive effects of digital technology, such as increasing competitiveness and efficiency (Baptista et al., 2020). These technologies facilitate the adoption of new work practices, strengthen organizational identity, and promote social interaction among employees (Trenerry et al., 2021; Wessel et al., 2021). Furthermore, digital tools enhance interaction and communication (Cao & Ali, 2018), thereby encouraging collaborative work and facilitating knowledge transfer (Cao et al., 2016).

The role of employees in driving successful digital transformation within organizations is crucial, as highlighted by da Silva et al. (2022). Employees are the catalysts that push this change forward. Aligning personal and organizational resources to effectively adopt new technologies is essential for achieving digital transformation. A comprehensive study by Trenerry et al. (2021) emphasizes the importance of skill development and training, identifying them as critical factors for organizations striving for effective digital transformation. Training programs designed to enhance digital competence are not just supplementary but are foundational to the success of digital initiatives. Moreover, these programs must be strategically developed to address the specific needs of the organization, ensuring that employees are equipped with relevant skills to handle modern technology. Additionally, individuals must possess advanced competence, knowledge, and proficiency in digital, information, and media literacy, which includes the acquisition and use of information technology (van Laar et al., 2020). These skills are not limited to basic digital skills but extend to a deep understanding of the digital ecosystem, data analysis, cybersecurity, and other technological domains. Employees also need to be adept at leveraging these skills to innovate, solve problems, and enhance productivity in their roles.

Employees must also adapt to the evolving job demands and organizational protocols related to rapidly growing digital competencies (van Laar et al., 2020). This adaptability is crucial as digital transformation is a dynamic process characterized by continuous progress and change. Employees must also be flexible and willing to update their skills and knowledge to keep pace with these changes.

Several comprehensive digital competency frameworks have been developed to guide the development of digital skills for citizens, students, and educators. The most prominent is the European Digital Competence Framework (DigComp), created by the European Commission (European Commission, 2021). DigComp outlines five key competence areas: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving (European Commission, 2022; European Schools, 2020). Each area encompasses specific skills and knowledge requirements, with examples and proficiency levels. While DigComp is widely accepted, its broad scope may make it challenging to apply to specific sectors or applications. Additionally, this framework may require adaptation to fit different cultural and educational contexts.

Other notable frameworks include DigCompEdu, which focuses on educators' digital skills to integrate technology into teaching and learning, and the ISTE Standards for Students, which outline digital competencies for students to thrive in a digital world. Although comprehensive, these frameworks can be challenging to implement uniformly across various educational environments due to varying levels of access to technology and resources. The ACRL Framework for Information Literacy in Higher Education provides a theoretical foundation for information literacy but may require additional practical guidance for effective implementation. Similarly, the UNESCO ICT Competency Framework for Teachers aims to improve teachers' ICT integration but needs adaptation to local contexts and continuous updates to keep pace with technological advancements. Overall, while

these frameworks offer valuable guidance, their broad scope and need for contextualization can present challenges for widespread and consistent adoption (European Commission, 2021).

Table 1: Comparison of Existing Digital Frameworks

Framework	Digital Literacy	Digital Skills	Communication and Collaboration	Problem Solving and Critical Thinking	Digital Safety and Security	Professional Development and Engagement	Digital Transformation and Governance	Digital Creation and Innovation	Digital Ethics and Inclusion	Application Skills and Functions
DigComp	✓	✓	✓	✓	✓			✓		
DigCompEdu						✓				
ISTE Standards for Students	✓		✓	✓						
Jisc Digital Capabilities	✓	✓		✓		✓		✓		
ACRL Digital Literacy	✓								✓	
DQ Framework	✓				✓			✓	✓	
Essential Digital Skills	✓		✓	✓	✓					
ACRL Framework				✓				✓		

This comparative table highlights various digital competency frameworks used internationally, with a focus on digital literacy and related skills. These frameworks cover several key areas of competency, including digital literacy, digital skills, communication and collaboration, problem-solving and critical thinking, digital safety and security, professional development and engagement, digital transformation and governance, digital creation and innovation, digital ethics and inclusion, as well as application skills and functions.

Some frameworks, such as the European Digital Competence Framework (DigComp) and ISTE Standards for Students, encompass almost all of the listed competency areas. Other frameworks, like the ACRL Digital Literacy Competency Standards and the Essential Digital Skills Framework (UK), focus more specifically on certain aspects such as digital literacy and digital safety. There are also frameworks that emphasize professional engagement and development, such as the Digital Competence Framework for Educators (DigCompEdu) and the Jisc Digital Capabilities Framework.

Overall, this comparison demonstrates that while each framework has a different focus, they all aim to enhance digital competencies in various contexts, whether in education, work, or everyday life.

3.0   METHODOLOGY

This study aims to develop a comprehensive digital skills framework for public officers, based on the needs of digital transformation. The methodology for this study is designed to systematically identify and validate the critical components of digital skills required by public officers to effectively drive digital transformation within their organizations. The study methodology consists of four main phases: identification of information needs, data collection, data analysis, and framework development.

3.1   Phase One: Identification of Information Needs

The first phase involves identifying the specific information needed to develop the digital skills framework. This includes:
•   Literature Review: Conducting a thorough review of digital competency frameworks used by public sector organizations both locally and internationally as benchmarks for the study.
•   Expert Consultation: Involving experts in digital transformation, ICT, and public administration to gather insights on the critical digital skills required for public officers. These experts will provide valuable input on the latest technology trends and best practices in digital skills development.

3.2 Phase Two: Data Collection

The second phase involves data collection to ensure a comprehensive understanding of the digital skills required by public officers. This phase is conducted quantitatively.
- Instrument Preparation: A survey instrument is developed. This survey lists components derived from existing frameworks such as DigComp, DigCompEdu, ISTE Standards for Students, and ACRL Digital Literacy.
- Component Validation Survey: This activity involves academics, industry professionals, and senior public officers with expertise in digital transformation and public administration to validate the identified digital skills framework components, ensuring relevance and applicability. The survey is distributed through targeted channels such as email and professional networks to reach relevant experts.

3.3 Phase Three: Data Analysis

The third phase involves analyzing the data collected to develop a digital skills framework. Statistical analysis of survey responses is conducted to validate components and confirm the relevance and importance of the identified digital competencies, in collaboration with experts. The calculation method by Yusoff (2019) is used in this study, considering the Content Validity Index (CVI), Item Content Validity Index (I-CVI), Universal Agreement (UA), Scale Content Validity Index based on average (S-CVI/Ave), and Scale Content Validity Index (S-CVI/UA).

CVI is used to assess the reliability and measure the extent to which items are relevant to the desired measurement objective. The evaluation process involves a panel of experts who assess each item in terms of relevance using a predetermined scale. The CVI is calculated by taking the number of experts who agree that an item is relevant, divided by the total number of experts who provided ratings. The CVI value ranges from 0 to 1, where a higher value indicates a higher consensus among the experts regarding the relevance of the item.

The results of the CVI help the researcher or investigator make decisions about refining or removing items in the measurement instrument. A high CVI indicates that the instrument has good content reliability and is suitable for use in the study or measurement being conducted. Besides CVI, other measurements include:
- The I-CVI is evaluated by comparing the number of experts who agree that an item is relevant. A high value indicates good consensus, where the experts believe that the content of the instrument is relevant for use in the study.
- UA refers to the evaluation method where all or nearly all experts involved in the research agree that an item in the measurement instrument is relevant to the study's objectives. This method is important for consistently assessing the content reliability of items by experts.
- S-CVI/Ave is used to assess the overall reliability of the instrument. S-CVI/Ave is calculated by taking the average of the Item-level I-CVI values for all items in the instrument. A high S-CVI/Ave value indicates good agreement among experts regarding the overall relevance of the instrument. This result helps the researcher ensure the content reliability of the instrument before using it in the study and also determines steps to refine the instrument.
- S-CVI/UA only considers items that receive uniform agreement among experts. A high S-CVI/UA value indicates a high consensus among experts regarding the overall relevance of the instrument to the measurement objectives.

3.4 Phase Four: Framework Development

Based on a comprehensive analysis of the collected data, this phase involves the thorough development of the digital skills framework.
- Identification of Components: Finalize the essential components of digital skills needed for public officers based on findings from the data analysis.
- Framework Structuring: Construct a well-structured and practical framework by detailing specific competencies, competency levels, and training recommendations.

3.4.1 Framework Development

To develop the framework, identifying the components is crucial. Based on the literature review conducted, the following components have been identified as important:
- Digital Literacy (C1): The ability to use information and communication technology to efficiently and critically search for, evaluate, create, and communicate information.
- Digital Skills (C2): The ability to use digital devices, applications, and networks to effectively access and manage information.
- Communication and Collaboration (C3): The ability to interact, communicate, and collaborate using digital tools, as well as manage digital identity.
- Problem-Solving and Critical Thinking (C4): The ability to identify, evaluate, and solve problems using digital tools and technologies.

- Digital Security and Safety (C5): Knowledge and practices to protect personal and professional data from cyber threats.
- Professional Development and Engagement (C6): The use of digital tools for professional growth and engagement in professional communities.
- Digital Transformation and Governance (C7): Skills to manage and drive digital change within organizations, including strategic planning and ethical governance.
- Digital Creation and Innovation (C8): The ability to create new digital content and innovate using digital tools.
- Digital Ethics and Inclusion (C9): Understanding the ethical implications of digital technology use and promoting inclusive practices.
- Functional Skills and Applications (C10): Practical skills for using digital devices and applications in daily tasks.

These components have been presented to experts for validation. The findings from the component validation are explained in the following section.

Below are the list of subcomponents of component:

Digital Literacy (C1) Subcomponents

- Information and Data Literacy: The ability to find, evaluate, use, and communicate information in all its formats.
- Digital Citizen: A person who uses the internet regularly and effectively, demonstrating responsible and ethical behavior.
- Digital Identity and Wellbeing: Managing one's digital presence and understanding the impact of digital activities on mental and physical health.
- Information and Media Literacy: Skills needed to critically analyze and create information across various media formats.
- ICT Proficiency: The ability to use digital technologies, communication tools, and networks to access and manage information.
- Basic Functional Skills: Fundamental skills necessary for performing essential tasks using digital devices and applications.
- Digital Communication: The exchange of information through digital platforms and tools.
- Digital Content Creation: The process of creating and sharing digital content such as text, images, audio, and video.
- Digital Awareness: Understanding the digital environment and the impacts of digital activities on individuals and society.

Digital Skills (C2) Subcomponents

- Basic Computer Skills: Fundamental skills required to operate a computer, such as using a mouse, keyboard, and basic software.
- Online Essentials: Basic skills for navigating the internet, including browsing, email, and online communication.
- Word Processing: The ability to create, edit, and format documents using word processing software.
- Spreadsheets: Skills for organizing, analyzing, and presenting data using spreadsheet software.
- IT Security: Protecting digital information and systems from threats.
- Cybersecurity: Protecting networks, systems, and data from digital attacks.
- Data Analytics: The process of analyzing raw data to find trends and answer questions.
- Digital Innovation: The use of digital technology to create new or improved processes, products, or services.
- Software Development: The process of designing, coding, testing, and maintaining software applications.
- AI Basics: Fundamental understanding of artificial intelligence concepts and applications.
- Programming: Writing code to create software programs.
- IoT: Internet of Things, the network of interconnected devices that can communicate and exchange data.
- Cloud Computing: Delivering computing services over the internet, including storage, processing, and software.
- Digital Marketing: Using digital channels to promote products and services.

Communication and Collaboration (C3) Subcomponents

- Communication: The exchange of information through various digital platforms.
- Online Collaboration: Working together with others using digital tools and platforms.
- Transacting: Conducting business transactions through digital means.
- Presentation: The skill of creating and delivering content to an audience using digital tools.

- Creative Communicator: Using digital media and tools to express ideas creatively.
- Global Collaboration: Working with individuals or groups from different geographical locations using digital platforms.

Problem-Solving and Critical Thinking (C4) Subcomponents

- Problem-Solving: The process of identifying solutions to complex issues using digital tools and methodologies.
- Critical Thinking: The ability to analyze information objectively and make reasoned judgments.
- Research and Information Fluency: Skills for conducting research and fluently using information.
- Computational Thinker: Applying computational methods to solve problems.
- Innovative Designer: Using a variety of digital tools to design innovative solutions.

Digital Safety and Security (C5) Subcomponents

- Safety: Ensuring personal safety while using digital technologies.
- Security and Privacy: Protecting personal information and maintaining privacy online.
- Cybersecurity: Measures taken to protect digital systems and data from cyber threats.
- IT Security: Protecting digital information and IT systems.

Professional Development and Engagement (C6) Subcomponents

- Professional Engagement: Actively participating in professional communities and activities using digital tools.
- Digital Resources: Digital materials and tools that support learning and professional activities.
- Empowering Learners: Using digital tools to support and enhance student learning.
- Career-Related Competences: Skills and knowledge needed for career development in a digital world.
- Career Development: Using digital tools to support professional growth and career planning.
- Digital Leadership: Leading and managing digital transformation and initiatives.
- Pedagogy: Teaching methods and practices that incorporate digital technologies.

Digital Transformation and Governance (C7) Subcomponents

- Strategy and Architecture: Planning and designing digital systems and infrastructures.
- Business Change: Managing organizational change through digital transformation.
- Solution Development and Implementation: Creating and deploying digital solutions.
- Service Management: Managing digital services to meet organizational needs.
- Procurement and Management Support: Acquiring and managing digital resources and services.
- Digital Transformation Skills: Skills needed to drive digital change in organizations.
- ICT Governance: Managing and overseeing ICT resources and policies.
- Digital Infrastructure: The physical and virtual resources that support digital services.
- Digital Services: Online services provided by organizations.
- Government Service Digitization: Transforming government services using digital technologies.
- Smart City Initiatives: Using digital technologies to improve urban services and quality of life.
- Digital Economy: Economic activities driven by digital technologies.
- e-Government: Delivering government services through digital platforms.
- Data Management: Collecting, storing, and using data effectively.

Digital Creation and Innovation (C8) Subcomponents

- Digital Creation: The process of creating digital content and products.
- Digital Innovation: Developing new ideas and solutions using digital technologies.
- Digital Entrepreneurship: Using digital technologies to create and manage new businesses.

Digital Ethics and Inclusion (C9) Subcomponents

- Digital Ethics: Principles and practices for ethical behavior in digital environments.
- Digital Inclusion: Ensuring equal access to digital technologies and opportunities.
- Social Participation: Engaging in social activities and communities through digital platforms.
- Financial Literacy: Understanding and managing financial matters using digital tools.
- Readiness: Preparedness to use digital technologies effectively.
- Availability: Ensuring digital resources are available and accessible.
- Digital Emotional Intelligence: Understanding and managing emotions in digital interaction.

Functional Skills and Applications (C10) Subcomponents

- Functional Skills: Basic skills needed to perform everyday tasks using digital tools.
- Workplace Skills: Digital skills necessary for workplace productivity.
- Transversal Skills: Transferable skills that are useful across various digital contexts.
- Self-Management: Using digital tools for personal organization and management.
- Personal and Family Life: Using digital technologies in everyday personal and family activities.
- Mathematical Practice: Applying digital tools to solve mathematical problems

4.0   FINDINGS

A questionnaire was sent to experts involved in the digital skills of public officers. Seven experts provided feedback. The experts consisted of academics, management personnel, and industry professionals involved in digital skills. Based on the findings, 100% agreed that the digital skills framework is crucial and relevant for public officers. The assessment of each component is as shown in Table 2.

Table 2: Relevance Assessment on Item Scale by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Item											
C1	1	1	1	1	1	1	1		7	1	1
C2	1	1	1	1	1	1	1		7	1	1
C3	1	1	1	1	1	1	1		7	1	1
C4	1	1	1	1	1	1	1		7	1	1
C5	1	1	1	1	1	0	1		6	0.86	0
Q6	1	1	0	1	1	1	1		6	0.86	0
C7	1	1	1	1	1	1	1		7	1	1
C8	1	1	1	1	1	1	0		6	0.86	0
C9	1	0	1	1	1	1	1		6	0.86	0
C10	1	1	1	1	1	1	1		7	1	1
									S-CVI/Ave	0.94	
Proportion of Importance	1	0.9	0.9	1	1	0.9	0.9		**S-CVI/UA**		0.6
	Average ratio of items assessed as relevant by 7 experts							0.94			

Table 2 shows the relevance assessment for ten items (C1 to C10) evaluated by seven experts in the relevant field. Four items (C1, C2, C3, and C4), as well as C7 and C10, received full approval from all experts with a relevance score of 1, indicating universal agreement (UA) and a perfect Item Content Validity Index (I/CVI) of 1. This indicates that these items are considered completely relevant by all experts.

However, there are some items (C5, C6, C8, and C9) that did not receive full approval, with one expert rating these items as not relevant. Therefore, these items have an I/CVI of 0.86 and no universal agreement (UA 0).

The Scale Content Validity Index based on average (S-CVI/Ave) is 0.94, reflecting a high level of overall agreement among experts regarding the relevance of the items. Meanwhile, the Scale Content Validity Index based on Universal Agreement (S-CVI/UA) is 0.6, indicating that 60% of the items received full approval from all experts.

The row "Proportion of Importance" shows variation in the importance ratings by experts, with values ranging from 0.9 to 1. This may reflect individual differences in opinions regarding the relative importance of each item.

Overall, Table 2 shows that all components are considered relevant by experts with a high level of agreement. This indicates that the assessed scale has valid and relevant content for the intended purposes.

4.1 Assessment of subcomponents for each components

Table 3 shows the evaluation of the Digital Literacy component by seven experts, which shows that several subcomponents received high relevance ratings, with Information and Data Literacy, Information, and Media Literacy and Digital Communication achieving perfect scores for relevance (I/CVI = 1.00) and universal agreement (UA = 1), indicating unanimous expert consensus on their importance. Other subcomponents, such as Digital Citizen, Digital Identity and Wellbeing, ICT Proficiency, Basic Functional Skills, and Digital Awareness, were also rated as relevant but did not achieve universal agreement, with I/CVI scores ranging from 0.71 to 0.86. Notably, Digital Content Creation received the lowest I/CVI score of 0.57, reflecting significant disagreement among experts regarding its relevance.

Table 3: Relevance Assessment on subcomponents of Digital Literacy by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Information and data literacy	1	1	1	1	1	1	1		7	1	1
Digital citizen	1	1	1	1	1	0	0		5	0.71	0
Digital identity and wellbeing	1	1	1	1	1	1	0		6	0.86	0
Information and media literacy	1	1	1	1	1	1	1		7	1	1
ICT proficiency	1	1	0	1	1	1	1		6	0.86	0
Basic functional skills	1	1	1	1	1	0	1		6	0.86	0
Digital communication	1	1	1	1	1	1	1		7	1	1
Digital content creation	0	1	0	1	1	1	0		4	0.57	0
Digital awareness	0	1	1	1	1	1	1		6	0.86	0
									S-CVI/Ave	0.86	
proportion relevance	0.78	1	0.78	1	1	0.78	0.67		S-CVI/UA		0.33
Average proportion of items judged as relevance across the 7 experts								0.86			

Overall, the average proportion of items judged as relevant across the experts was 0.86, with an S-CVI/Ave of 0.86 and an S-CVI/UA of 0.33, highlighting that while most subcomponents were considered relevant, only a third achieved full agreement from all experts. This suggests that while Digital Literacy is seen as crucial, some subcomponents may need further review or clarification to reach consensus on their importance.

Table 4 shows the evaluation of the Digital Skills component by seven experts, which shows that several subcomponents, such as Basic Computer Skills, Online Essentials, Word Processing, and Spreadsheets, received high relevance ratings, with perfect scores for both relevance (I/CVI = 1.00) and universal agreement (UA = 1), indicating unanimous expert consensus on their importance. Other subcomponents, like Cybersecurity, Data Analytics, and Digital Innovation, were also rated as relevant but did not achieve universal agreement, with I/CVI scores of 0.86. However, subcomponents such as IT Security, AI Basics, Programming, IoT, Cloud Computing, and Digital Marketing showed more varied expert opinions, with I/CVI scores ranging from 0.43 to 0.71, suggesting moderate relevance and some disagreement.

Overall, the average proportion of items judged as relevant across the experts was 0.82, with an S-CVI/Ave of 0.82 and an S-CVI/UA of 0.43. This indicates that while most subcomponents were considered relevant, less than half achieved full agreement among all experts. This suggests that while Digital Skills are generally seen as important, some subcomponents may need further review or clarification to reach a stronger consensus on their relevance.

Table 4: Relevance Assessment on subcomponents of Digital Skills by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Basic computer skills	1	1	1	1	1	1	1		7	1	1
Online essentials	1	1	1	1	1	1	1		7	1	1
Word processing	1	1	1	1	1	1	1		7	1	1
Spreadsheets	1	1	1	1	1	1	1		7	1	1
IT security	1	1	1	1	1	0	0		5	0.71	0
Cybersecurity	1	1	1	1	1	1	0		6	0.86	0
Data analytics	1	1	0	1	1	1	1		6	0.86	0
Digital innovation	1	1	1	1	1	1	1		7	1	1
Software development.	0	1	0	1	1	0	0		3	0.43	0
AI basics.	1	1	1	1	1	1	1		7	1	1
Programming	0	1	0	1	1	0	0		3	0.43	0
IoT	0	1	0	1	1	1	1		5	0.71	0
Cloud computing	1	1	0	1	1	1	1		6	0.86	0
Digital marketing	0	1	0	1	1	1	0		4	0.57	0
									S-CVI/Ave	0.82	
proportion relevance	0.71	1	0.57	1	1	0.79	0.64		S-CVI/UA		0.43
Average proportion of items judged as relevance across the 7 experts								0.82			

Table 5 shows the evaluation of the Communication and Collaboration component by seven experts shows that subcomponents like Communication and Presentation received high relevance ratings, achieving perfect scores for both relevance (I/CVI = 1.00) and universal agreement (UA = 1), indicating unanimous expert consensus on their importance. Other subcomponents, such as Online Collaboration, Transacting, and Creative Communicator, were also rated as relevant but did not achieve universal agreement, with I/CVI scores of 0.86. Global Collaboration had the lowest I/CVI score of 0.71, reflecting the most disagreement among experts regarding its relevance.

Overall, the average proportion of items judged as relevant across the experts was 0.88, with an S-CVI/Ave of 0.88 and an S-CVI/UA of 0.33. This suggests that while most subcomponents were considered relevant, only a third achieved full agreement from all experts. These results imply that while Communication and Collaboration skills are generally seen as crucial, some subcomponents may need further review or clarification to reach consensus on their importance.

Table 6 shows the evaluation of the Problem-Solving and Critical Thinking component by seven experts, which indicates strong consensus on the importance of most subcomponents. Problem-Solving, Critical Thinking, and Research and Information Fluency each received perfect relevance scores (I/CVI = 1.00) and universal agreement (UA = 1), highlighting unanimous expert consensus on their significance. The subcomponent Innovative Designer was also rated as relevant but did not achieve universal agreement, with an I/CVI score of 0.86, indicating some variance in expert opinions.

Overall, the average proportion of items judged as relevant across the experts was 0.94, with an S-CVI/Ave of 0.94 and an S-CVI/UA of 0.60. This suggests that while the majority of subcomponents in this category were considered highly relevant, some did not receive full agreement from all experts. These results imply that Problem-Solving and Critical Thinking skills are generally seen as crucial, but there may still be room for discussion or clarification on certain subcomponents to reach full consensus on their importance.

Table 5: Relevance Assessment on subcomponents of Communication and Collaboration by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Communication	1	1	1	1	1	1	1		7	1	1
Online collaboration	1	1	0	1	1	1	1		6	0.86	0
Transacting	1	1	1	1	1	1	0		6	0.86	0
Presentation	1	1	1	1	1	1	1		7	1	1
Creative communicator	1	1	1	1	1	1	0		6	0.86	0
Global collaboration	1	1	0	1	1	1	0		5	0.71	0
									S-CVI/Ave	0.88	
proportion relevance	1	1	0.67	1	1	1	0.5		S-CVI/UA		0.33
Average proportion of items judged as relevance across the 7 experts								0.88			

Table 6: Relevance Assessment on subcomponents of Problem-Solving and Critical Thinking by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Problem-solving	1	1	1	1	1	1	1		7	1	1
Critical thinking	1	1	1	1	1	1	1		7	1	1
Research and information fluency	1	1	1	1	1	1	1		7	1	1
Computational thinker	1	1	1	1	1	1	0		6	0.86	0
Innovative designer	1	1	1	1	1	1	0		6	0.86	0
									S-CVI/Ave	0.94	
proportion relevance	1	1	1	1	1	1	0.6		S-CVI/UA		0.6
Average proportion of items judged as relevance across the 7 experts								0.94			

Table 7: Relevance Assessment on subcomponents of Digital Safety and Security by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Safety	1	1	1	1	1	1	1		7	1	1
Security and privacy	1	1	1	1	1	1	1		7	1	1
Cybersecurity	1	1	1	1	1	1	1		7	1	1
IT security	1	1	1	1	1	0	1		6	0.86	0
									S-CVI/Ave	0.97	
proportion relevance	1	1	1	1	1	0.75	1		S-CVI/UA		0.75
Average proportion of items judged as relevance across the 7 experts								0.96			

Table 7 shows the evaluation of the Digital Safety and Security component by seven experts, which demonstrates a strong consensus on the relevance of most subcomponents. Safety, Security and Privacy, and Cybersecurity all received perfect relevance scores (I/CVI = 1.00) and universal agreement (UA = 1), indicating unanimous expert consensus on their importance. However, the IT Security subcomponent received a slightly lower relevance score (I/CVI = 0.86), reflecting some disagreement among experts.

Overall, the average proportion of items judged as relevant across the experts was 0.96, with an S-CVI/Ave of 0.97 and an S-CVI/UA of 0.75. These results suggest that Digital Safety and Security subcomponents are considered highly relevant by the majority of experts, but there are minor discrepancies in the agreement on certain elements.

Table 8: Relevance Assessment on subcomponents of Professional Development and Engagement by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Professional engagement	1	1	0	1	1	1	1		6	0.86	0
Digital resources	1	1	1	1	1	1	1		7	1	1
Empowering learners	0	1	1	1	1	1	1		6	0.86	0
Career-related competences	1	1	1	1	1	1	1		7	1	1
Career development	1	1	1	1	1	1	1		7	1	1
Digital leadership	1	1	1	1	1	1	1		7	1	1
Pedagogy	1	1	1	1	1	1	1		7	1	1
									S-CVI/Ave	0.96	
proportion relevance	0.86	1	0.86	1	1	1	1		S-CVI/UA		0.71
Average proportion of items judged as relevance across the 7 experts								0.96			

Table 8 shows the evaluation of the Professional Development and Engagement component that indicates strong expert agreement on most subcomponents. Digital Resources, Career-Related Competences, Career Development, Digital Leadership, and Pedagogy all achieved perfect relevance scores (I/CVI = 1.00) and universal agreement (UA = 1), showing a high level of consensus on their importance. The subcomponents Professional Engagement and Empowering Learners received lower relevance scores (I/CVI = 0.86) with some disagreement, indicating areas of differing expert opinions.

Overall, the average proportion of items judged as relevant by the experts was 0.96, with an S-CVI/Ave of 0.96 and an S-CVI/UA of 0.71. This suggests that while the majority of subcomponents were deemed highly relevant, there is some room for further discussion or clarification on certain aspects to achieve full consensus.

Table 9 shows is the evaluation of the Digital Transformation and Governance component reveals mixed levels of agreement among the seven experts on the relevance of its subcomponents. Subcomponents like Digital Transformation Skills, ICT Governance, Digital Services, Government Service Digitization, Digital Economy, e-Government, and Data Management received perfect relevance scores (I/CVI = 1.00) and universal agreement (UA = 1), showing strong consensus on their importance.

However, other subcomponents such as Strategy and Architecture and Solution Development and Implementation had lower relevance scores (I/CVI = 0.71) with no universal agreement, indicating varying expert opinions. Business Change, Service Management, Procurement and Management Support, and Digital Infrastructure scored moderately (I/CVI = 0.86), suggesting partial agreement among experts.

Overall, the average proportion of items judged as relevant across the experts was 0.9, with an S-CVI/Ave of 0.9 and an S-CVI/UA of 0.5. These results indicate that while most subcomponents are viewed as crucial, there is significant variation in agreement levels, highlighting areas that may benefit from further clarification or discussion among experts.

Table 9: Relevance Assessment on subcomponents of Digital Transformation and Governance by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Strategy and architecture	0	1	1	1	1	1	0		5	0.71	0
Business change	0	1	1	1	1	1	1		6	0.86	0
Solution development and implementation	0	1	1	1	1	1	0		5	0.71	0
Service management	0	1	1	1	1	1	1		6	0.86	0
Procurement and management support	0	1	1	1	1	1	1		6	0.86	0
Digital transformation skills	1	1	1	1	1	1	1		7	1	1
ICT governance	1	1	1	1	1	1	1		7	1	1
Digital infrastructure	1	1	1	1	1	0	1		6	0.86	0
Digital services	1	1	1	1	1	1	1		7	1	1
Government service digitization	1	1	1	1	1	1	1		7	1	1
Smart city initiatives	0	1	0	1	1	1	1		5	0.71	0
Digital economy	1	1	1	1	1	1	1		7	1	1
e-Government	1	1	1	1	1	1	1		7	1	1
Data management	1	1	1	1	1	1	1		7	1	1
									S-CVI/Ave	0.9	
proportion relevance	0.57	1	0.93	1	1	0.93	0.86		S-CVI/UA		0.5
Average proportion of items judged as relevance across the 7 experts								0.9			

Table 10: Relevance Assessment on subcomponents of Digital Creation and Innovation by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Digital creation	1	1	1	1	1	1	1		7	1	1
Digital innovation	1	1	1	1	1	1	1		7	1	1
Digital entrepreneurship	0	1	0	1	1	1	0		4	0.57	0
									S-CVI/Ave	0.86	
proportion relevance	0.67	1	0.67	1	1	1	0.67		S-CVI/UA		0.67
Average proportion of items judged as relevance across the 7 experts								0.86			

Table 10 shows the evaluation of the Digital Creation and Innovation component by seven experts, which reveals a high level of agreement on the relevance of key subcomponents. Digital Creation and Digital Innovation both received perfect relevance scores (I/CVI = 1.00) and universal agreement (UA = 1), reflecting unanimous expert consensus on their importance. In contrast, Digital Entrepreneurship received a lower relevance score (I/CVI = 0.57), indicating some disagreement among experts.

Overall, the average proportion of items judged as relevant across the experts was 0.86, with an S-CVI/Ave of 0.88 and an S-CVI/UA of 0.67. These results suggest that while most subcomponents are considered highly relevant, there is a notable difference in opinions regarding Digital Entrepreneurship.

Table 11: Relevance Assessment on subcomponents of Digital Ethics and Inclusion by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Digital ethics	1	1	1	1	1	1	1		7	1	1
Digital inclusion	1	1	1	1	1	1	1		7	1	1
Social participation	0	1	1	1	1	1	1		6	0.86	0
Financial literacy	0	1	1	1	1	1	1		6	0.86	0
Readiness	1	1	1	1	1	1	1		7	1	1
Availability	0	1	1	1	1	1	1		6	0.86	0
Digital emotional intelligence	1	1	1	1	1	1	1		7	1	1
									S-CVI/Ave	0.94	
proportion relevance	0.57	1	1	1	1	1	1		S-CVI/UA		0.57
Average proportion of items judged as relevance across the 7 experts								0.94			

Table 11 shows the evaluation of the Digital Ethics and Inclusion component by seven experts, which indicates a strong consensus on the relevance of most subcomponents. Digital Ethics, Digital Inclusion, and Digital Emotional Intelligence all received perfect relevance scores (I/CVI = 1.00) and universal agreement (UA = 1), showing unanimous agreement on their importance. However, Financial Literacy, Social Participation, and Availability each received a slightly lower relevance score (I/CVI = 0.86), reflecting some divergence in expert opinions.

Overall, the average proportion of items judged as relevant across the experts was 0.94, with an S-CVI/Ave of 0.94 and an S-CVI/UA of 0.57. These results suggest that most subcomponents are deemed highly relevant, with minor discrepancies in the agreement on certain elements

Table 12: Relevance Assessment on subcomponents of Functional skills and application by 7 Experts

	E1	E2	E3	E4	E5	E6	E7		Experts in Agreement	I/CVI	UA
Functional skills	1	1	1	1	1	1	1		7	1	1
Workplace skills	1	1	1	1	1	1	1		7	1	1
Transversal skills	1	1	1	1	1	1	1		7	1	1
Self-management	1	1	1	1	1	1	1		7	1	1
Personal and family life	1	1	1	1	1	0	1		6	0.86	0
Mathematical practice	1	1	1	1	1	1	1		7	1	1
									S-CVI/Ave	0.98	
proportion relevance	1	1	1	1	1	0.83	1		S-CVI/UA		0.83
Average proportion of items judged as relevance across the 7 experts								0.98			

Table 12 shows the evaluation of the Functional Skills and Application component by seven experts that demonstrates unanimous agreement on the relevance of several subcomponents. Functional Skills, Workplace Skills, and Transversal Skills all received perfect relevance scores (I/CVI = 1.00) and universal agreement (UA = 1). Mathematical Practice received a slightly lower relevance score (I/CVI = 0.83), indicating some disagreement among experts.

Overall, the average proportion of items judged as relevant across the experts was 0.98, with an S-CVI/Ave of 0.98 and an S-CVI/UA of 0.83. These results indicate that Functional Skills and Application subcomponents are considered highly relevant, though there are slight differences in expert opinions on Mathematical Practice.

5.0   DISCUSSION

Based on the results discussed, all components were accepted by the experts. A proposed framework was developed.

Fig. 1: Digital Skills Framework for Public Officers

The digital skills framework for public officers, which includes digital literacy, digital skills, communication and collaboration, problem-solving and critical thinking, digital security and safety, professional development and engagement, digital transformation and governance, digital creation and innovation, digital ethics and inclusion, as well as functional skills and applications, aligns with existing digital frameworks such as the "European Digital Competence Framework for Citizens" (DigComp). DigComp also emphasizes fundamental skills like digital literacy, security, problem-solving, and collaboration as key elements to enhance digital competence and ensure more effective participation in the digital society (Carretero et al., 2017).

The components in this framework are also consistent with the elements outlined by UNESCO in the UNESCO ICT Competency Framework for Teachers, which highlights the importance of digital literacy, problem-solving skills, communication and collaboration, and ethics in the use of information and communication technology (ICT). UNESCO also underscores the need for ongoing and inclusive professional development to ensure that educators and public workers can efficiently and effectively adapt to new technologies (UNESCO, 2018). By referring to the principles set by UNESCO, this digital skills framework is expected to serve as a comprehensive and practical guide in the effort to drive digital transformation among public officers.

Based on the survey conducted with 7 experts, the following components and subcomponents were accepted as relevant for the digital skills framework:

Digital Literacy (C1)

- Information and data literacy
- Digital identity and wellbeing
- Information and media literacy
- ICT proficiency
- Basic functional skills
- Digital communication
- Digital awareness

Digital Skills (C2)

- Basic computer skills
- Online essentials
- Word processing
- Spreadsheets
- Cybersecurity
- Data analytics
- Digital innovation
- AI basics
- Cloud computing

Communication and Collaboration (C3)

- Communication
- Online collaboration
- Transacting
- Presentation
- Creative communicator

Problem-Solving and Critical Thinking (C4)

- Problem-solving
- Critical thinking
- Research and information fluency
- Computational thinker
- Innovative designer

Digital Safety and Security (C5)

- Safety
- Security and privacy
- Cybersecurity
- IT security

Professional Development and Engagement (C6)

- Professional engagement
- Digital resources
- Empowering learners
- Career-related competences
- Career development
- Digital leadership
- Pedagogy

Digital Transformation and Governance (C7)

- Business change
- Service management
- Procurement and management support

- Digital transformation skills
- ICT governance
- Digital infrastructure
- Digital services
- Government service digitization
- Digital economy
- e-Government
- Data management

Digital Creation and Innovation (C8)

- Digital creation
- Digital innovation

Digital Ethics and Inclusion (C9)

- Digital ethics
- Digital inclusion
- Social participation
- Financial literacy
- Readiness
- Availability
- Digital emotional intelligence

Functional skills and application (C10)

- Functional skills
- Workplace skills
- Transversal skills
- Self-management
- Personal and family life
- Mathematical practice

The survey findings indicate that the experts prioritized subcomponents that are more foundational and directly relevant to the practical application of digital skills. Components like Digital Literacy, Digital Skills, and Communication and Collaboration have a strong focus on essential digital competencies such as basic computer skills, cybersecurity, and online communication. This suggests a need for a balanced approach that combines foundational knowledge with advanced competencies to prepare individuals for the digital era.

Additionally, subcomponents such as Digital Ethics and Inclusion, and Digital Safety and Security emphasize the importance of ethical considerations and safeguarding digital activities. This reflects a growing recognition of the need to create a safe, inclusive, and responsible digital environment.

The inclusion of Digital Transformation as well as Governance and Professional Development and Engagement components points to a forward-looking perspective that focuses on organizational change, leadership, and continuous professional development, which are critical in a rapidly evolving digital landscape.

Overall, the accepted list of subcomponents provides a comprehensive framework that addresses both individual competencies and organizational needs, ensuring a holistic approach to digital skill development.

6.0 CONCLUSION

The development of a digital skills framework is crucial to ensuring the successful digital transformation of organizations. This framework serves as a foundational roadmap, outlining the essential elements and competencies that public officers need to effectively navigate and leverage modern digital technologies. As digital transformation becomes increasingly vital for enhancing organizational efficiency, competitiveness, and service delivery, having a clear framework helps systematically identify skill gaps and training needs. It ensures that employees possess the necessary digital literacy, ranging from basic technical skills to advanced competencies in data analysis, cybersecurity, and digital communication. Moreover, the framework provides a structured approach to continuous learning and professional development, enabling public officers to adapt to the evolving technological landscape and job demands. By fostering a culture of digital competency, the framework supports broader goals of innovation, collaboration, and agility, ultimately driving organizational success in the digital era.

REFERENCES

[1]   UNESCO, *Digital Transformation and Artificial Intelligence Competency Framework for Civil Servants*, 2022. [Online]. Available: https://www.unesco.org/en/digital-competency-frameworkW.-K. Chen, *Linear Networks and Systems*. Belmont, CA, USA: Wadsworth, 1993, pp. 123–135.

[2]   J. A. Xavier, "Digitalizing public service delivery: Malaysia," in *Digitalization of Public Service Delivery in Asia*, J. Choi and J. A. Xavier, Eds. Tokyo: Asian Productivity Organization, 2021, pp. 101–124. [Online]. Available: https://www.apo-tokyo.org/wp-content/uploads/2021/02/Digitalization-of-Public-Service-Delivery-in-Asia-final-1.pdf

[3]   M. A. Aziz, "Penjawat awam perlu bina kemahiran baharu," *Berita Harian*, Mar. 2022. [Online]. Available: https://www.bharian.com.my/berita/nasional/2022/03/935214/penjawat-awam-perlu-bina-kemahiran-baharu

[4]   N. I. Yaacob, H. Othman, M. Basri, and H. AB Rahman, "The use of knowledge management technology among Selangor State Government agencies," *Asia-Pacific Journal of Information Technology and Multimedia*, vol. 11, no. 01, pp. 39–53, 2022. [Online]. Available: https://doi.org/10.17576/apjitm-2022-1101-04

[5]   A. Mazurchenko and K. Maršíková, "Digitally-powered human resource management: Skills and roles in the digital era," *Acta Informatica Pragensia*, vol. 8, no. 2, pp. 72–87, 2019. [Online]. Available: https://doi.org/10.18267/j.aip.125

[6]   E. Flores, X. Xu, and Y. Lu, "Human capital 4.0: A workforce competence typology for Industry 4.0," *Journal of Manufacturing Technology Management*, vol. 31, no. 4, pp. 687–703, 2020. [Online]. Available: https://doi.org/10.1108/JMTM-08-2019-0309

[7]   E. van Laar, A. J. A. M. van Deursen, J. A. G. M. van Dijk, and J. de Haan, "Determinants of 21st-century digital skills: A large-scale survey among working professionals," *Computers in Human Behavior*, vol. 100, pp. 93–104, 2019. [Online]. Available: https://doi.org/10.1016/j.chb.2019.06.017

[8]   S. Zeiki, K. Bradbury, L. Lindert, and H. Pfaff, "Digital leadership skills and associations with psychological well-being," *International Journal of Environmental Research and Public Health*, vol. 16, no. 14, Article 2628, 2019. [Online]. Available: https://doi.org/10.3390/ijerph16142628

[9]   J. Baptista, M.-K. Stein, S. Klein, M. B. Watson-Manheim, and J. Lee, "Digital work and organisational transformation: Emergent Digital/Human work configurations in modern organisations," *The Journal of Strategic Information Systems*, vol. 29, no. 2, 2020. [Online]. Available: https://doi.org/10.1016/j.jsis.2020.101618

[10]   B. Trenerry *et al.*, "Preparing workplaces for digital transformation: An integrative review and framework of multi-level factors," *Frontiers in Psychology*, vol. 12, Article 620766, 2021. [Online]. Available: https://doi.org/10.3389/fpsyg.2021.620766

[11]   L. Wessel, A. Baiyere, R. Ologeanu-Taddei, J. Cha, and T. B. Jensen, "Unpacking the difference between digital transformation and IT-enabled organisational transformation," *Journal of the Association for Information Systems*, vol. 22, no. 1, pp. 102–129, 2021. [Online]. Available: https://doi.org/10.17705/1jais.00655

[12]   X. Cao and A. Ali, "Enhancing team creative performance through social media and transactive memory system," *International Journal of Information Management*, vol. 39, pp. 69–79, 2018. [Online]. Available: https://doi.org/10.1016/j.ijinfomgt.2017.11.009

[13]   X. Cao, X. Guo, D. Vogel, and X. Zhang, "Exploring the influence of social media on employee work performance," *Internet Research*, vol. 26, no. 2, pp. 529–545, 2016. [Online]. Available: https://doi.org/10.1108/IntR-11-2014-0299

[14]   L. B. P. da Silva *et al.*, "Human resources management 4.0: Literature review and trends," *Computers & Industrial Engineering*, vol. 168, p. 108111, 2022. [Online]. Available: https://doi.org/10.1016/j.cie.2022.108111

[15]   E. van Laar, A. J. A. M. van Deursen, J. A. G. M. van Dijk, and J. de Haan, "Determinants of 21st-century skills and 21st-century digital skills for workers: A systematic literature review," *SAGE Open*, vol. 10, no. 1, 2020. [Online]. Available: https://doi.org/10.1177/2158244019900176

[16]   European Commission, "The updated version of the digital competences framework now available online," 2021. [Online]. Available: https://www.epr.eu/the-updated-version-of-the-digital-competences-framework-now-available-online/

[17]   European Commission, "The Digital Competence Framework (DigComp)," 2022. [Online]. Available: https://joint-research-centre.ec.europa.eu/digcomp/digcomp-framework_en

[18]   European Schools, *The European Schools' Digital Competence Framework*, 2020. [Online]. Available: https://www.eursc.eu/BasicTexts/2020-09-D-51-en-2.pdf

[19]   M. S. B. Yusoff, "ABC of content validation and content validity index calculation," *Eastern International Medical Journal*, vol. 11, no. 2, pp. 49–54, 2019. [Online]. Available: https://doi.org/10.21315/eimj2019.11.2.6

[20]   S. Carretero, R. Vuorikari, and Y. Punie, *DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use*. Luxembourg: Publications Office of the European Union, 2017.

[21]   UNESCO, *UNESCO ICT Competency Framework for Teachers*, United Nations Educational, Scientific and Cultural Organization, 2018.