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Digital Competency of Primary School Design and Technology Teachers for the Implementation of Online Learning and Facilitation

(Kompetensi Digital Guru Reka Bentuk dan Teknologi Sekolah Rendah untuk Pelaksanaan Pembelajaran dan Pemudahcaraan Dalam Talian)

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ARTICLE INFO	Abstract
	This study was conducted to identify the dominant digital competency elements among Design and Technology (DT) teachers in primary schools for online learning and facilitation. Low digital competency among teachers, including DT teachers in primary schools, results in unsatisfactory online delivery of teaching and learning materials to students. Moreover, many teachers still rely on conventional methods instead of utilizing the Internet to support online teaching and learning. The study employed a quantitative survey approach. The researcher adapted and translated the DIGIGLO instrument into the Malay language. An online questionnaire (Google Form) was used to collect data effectively. The population of this study consisted of DT teachers in primary schools in the state of Johor who had been teaching the DT subject for five years and above. The sampling technique used was random sampling, and the selected respondents consisted of 283 teachers from that category. The Statistical Package for Social Science (SPSS) software was used to determine the highest mean scores for the digital competency elements. The findings of the study revealed that the most dominant element of digital competency among DT teachers in primary schools in the state of Johor was the Digital Resources element for online learning and facilitation. The findings of this study have implications for primary school DT teachers in identifying their needs for further training and professional development in their digital competencies.

INTRODUCTION

Digital competency refers to the knowledge, skills, and attitudes required when using Information and Communication Technology (ICT) and digital media to perform tasks and build knowledge (Al-Khateeb, 2017). He further explains this concept as the confident, critical, and creative use of ICT to achieve work-related goals. Teachers play a crucial role as exemplars for the next generation, underscoring the significance of equipping them with the digital competencies necessary for all individuals to actively engage in the digital society. Krumsvik et al., (2016) reported that teachers require three types of digital competencies: generic digital competencies related to the mastery of general skills and knowledge about educational technology and digital environments, subject-specific didactic digital competencies related to the application of digital competencies in specific subjects, and professional digital competencies referring to digital competencies relevant to the teaching profession but beyond teaching activities.

As dedicated professionals in the field of education, teachers require not only general digital competencies for personal and professional purposes but also specific digital competencies for proficiently incorporating technology into their teaching practices. Many teachers, including those teaching Design and Technology (DT) subjects, are not well-trained in conducting online teaching and facilitation. They face challenges such as a lack of digital competencies in conducting online teaching and facilitation, as well as a lack of technical infrastructure, such as laptops, internet access, and microphones for teaching. The DT subject provides students with the knowledge and technological skills to create various projects using the design process. Students are exposed to creativity through design exploration and the functional aspects of products. They also engage in manufacturing techniques and processes involving recycling materials and producing electrical projects. Teachers play a crucial role in this regard as they need to possess knowledge of the subject's curriculum standards in DT.

Each subject must be thoroughly understood by teachers. They must also make an ongoing effort to connect the curriculum standards more clearly. This is so that students can employ their critical thinking skills and real-world experiences in the DT subject's practical work. To help students with their practical work in DT, teachers of this subject must have their own pedagogy or teaching methods as well as adequate digital competencies. The proposed and updated DigCompEdu framework by the European Commission in 2016/17 provides a structure that enables European citizens to better understand the meaning of digital competence, assess, and further develop their digital competencies. According to a report presented by Redecker, C. (2017), The DigCompEdu framework was developed through extensive consultations with experts and practitioners, incorporating an initial review of relevant literature and the synthesis of existing tools and resources at various levels - local, national, European, and international. The objective of these discussions was to establish a shared agreement on the domains and fundamental components of digital competencies for educators. Additionally, the aim was to determine the essential and supplementary elements, as well as outline the logical progression of digital competencies within each domain. The DigCompEdu framework consists of six elements related to teachers' digital competencies: 1) Professional Engagement, 2) Digital Resources, 3) Digital Pedagogy, 4) Assessment, 5) Empowering Learners, and 6) Facilitating Learners' Digital Competence. In the context of this study, the researcher has adapted the DIGIGLO instrument, which contains 29 items, along with the six domains and 22 competencies included in DigCompEdu, considering two additional domains which are related to the educators' work environment, namely Digital Environment and Extrinsic Digital Commitment.

Therefore, based on the above discussion, the researcher conducted a study to identify the dominant digital competency elements among Design and Technology (DT) teachers in primary schools for online teaching and facilitation. The respondents of this study were

283 DT teachers in primary schools in the state of Johor who have been teaching DT for 5 years and above.

LITERATURE REVIEW

Cabero (2020) emphasized that digital competence, along with Technological Pedagogical Content Knowledge (TPCK), is one of the key competencies that citizens in general, and teachers, must master in the future society. TPCK refers to the knowledge and understanding that teachers need to effectively integrate technology into their pedagogical practices while considering the content they are teaching. In Spain, the National Digital Competence Plan (MINECO, 2021) recently identified the acquisition of Digital Competence, including TPCK, by teachers at all levels of education, as one of its main strategic axes. This recognition aligns with the plan's aim to foster sustainable and inclusive economic growth. Teachers play a crucial role in the process of integrating digital technologies, and their effective use depends on their ability to apply TPCK in their instructional practices. TPCK empowers teachers with the knowledge of how to leverage technology in ways that enhance content knowledge and pedagogical approaches. It involves understanding how to select appropriate digital tools and resources that align with the specific content being taught, as well as the pedagogical strategies that best support student learning. By combining technological, pedagogical, and content knowledge, teachers can create engaging and effective learning experiences for their students.

Digital competence, in conjunction with TPCK, provides teachers with the advantage of exploring innovative teaching approaches and integrating digital tools that promote creativity, problem-solving, and collaboration among students. It enables the creation of interactive multimedia materials, virtual field trips, and project-based learning experiences that inspire students to think critically and express their ideas in creative ways. Teachers with strong TPCK are better equipped to design and implement technology-rich lessons that effectively enhance student learning outcomes. However, challenges related to online teaching and facilitation, such as the lack of quality communication and interaction, technological limitations, low motivation, and inadequate support, can hinder the effective application of TPCK. Teachers need to receive adequate training and support to develop their TPCK and digital competence, enabling them to overcome these challenges and utilize technology in a way that enhances teaching and learning experiences.

Published in 2017, the European Framework for the Digital Competence of Educators (DigCompEdu) delineates precise digital competencies tailored to the teaching profession (Redecker, 2017). Developed through thorough expert consultations, this framework aims to organize diverse perspectives and empirical findings into a comprehensive model applicable to various educational settings. The DigCompEdu framework consists of six elements related to teachers' digital competencies: 1) Professional Engagement, 2) Digital Resources, 3) Digital Pedagogy, 4) Assessment, 5) Empowering Learners, and 6) Facilitating Learners' Digital Competence. According to this approach, teachers' general digital competencies are prerequisites for developing specific digital competencies as outlined in DigCompEdu. Furthermore, teachers are expected to possess subject-specific competences, pedagogical competences, and transversal competencies as additional prerequisites. Therefore, DigCompEdu aligns with the Technological, Pedagogical, and Content Knowledge (TPACK) framework published by Mishra and Koehler in 2006, which states that effective integration of technology in teaching requires the integration of three areas of knowledge: technological, pedagogical, and content knowledge. However, while TPACK does not explain how this relationship is established, DigCompEdu aims to discern the pedagogical and professional focal points that facilitate the integration of technology into teaching practices and professional endeavours. To ensure its relevance in diverse subjects and within the ever-evolving technological landscape, DigCompEdu prioritizes the pedagogical component while providing specific insights into how this relationship is established. DIGIGLO is a succinct and user-friendly tool for evaluating instructors' level

of digital proficiency. It adds two more domains of digital competence, broadening the scope of the DigCompEdu Framework (digital environment and extrinsic digital engagement). By using this tool, educators and their institutions can receive insightful feedback on their areas of strength and need for development in terms of using digital technology in the classroom (Alarcón et al., 2020). Digital Setting and Extrinsic Digital Commitment are included as two additional components of teachers' digital competence within the DIGIGLO instrument. The capabilities connected to digital software and hardware tools, unrestricted access to digital resources, ongoing chances for professional growth, and accessibility of research tools are all included in the digital environment.

METHODOLOGY

The study conducted was a survey study using a quantitative approach, and the research instrument used was an online questionnaire, adapted from the DIGIGLO instrument, to identify the dominant elements of digital competence among primary school DT teachers while conducting online teaching and facilitation. The questionnaire was administered using Google Forms. The researcher selected a sample for this study consisting of primary school DT teachers in the state of Johor who have been teaching DT for at least five years. A set of online questionnaires, Google Forms, consisting of two sections was used to identify the dominant elements of teachers' digital competence. The first section of the questionnaire focused on respondent demographics. The second section, called DIGIGLO, was designed to assess teachers' digital competence (Alarcón, R. et al., 2020). The adapted DIGIGLO instrument for this study included 43 items referring to eight domains of digital competence. The first six domains were: 1) Professional engagement (6 items), 2) Digital resources (6 items), 3) Digital pedagogy (6 items), 4) Assessment (6 items), 5) Empowering learners (6 items), and 6) Facilitating learners' digital competence (4 items). The other two domains about the digital resources and opportunities (logistics and ICT support services) available to educators in their work context: 7) Digital environment (5 items) and 8) Extrinsic digital commitment (4 items). Part B of the questionnaire required respondents to rate their level of agreement or disagreement with statements on a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The complete Google Form link, including all sections of the questionnaire, was provided to the study sample through WhatsApp and Telegram applications. The participants were given two weeks to respond to the questionnaire.

To ensure that every instrument constructed and used in this study is valid and reliable, the researcher employed expert validation and pilot study approaches. The DIGIGLO Digital Competencies of Teachers instrument adapted for this study has been validated by three experts. An Associate Professor from the Faculty of Technical and Vocational Education (FPTV), UTHM was chosen to review the instrument in terms of structure, wording, language, and format. The validity of the questionnaire was evaluated in terms of the suitability of the content and the content of the questionnaire. Two heads of panels from SJKC Kong Nan, the head of the Malay Language Panel and the head of the Design and Technology Panel, were selected to validate the questionnaire set from the perspective of using appropriate language that accurately conveys the intended meaning in Malay Language. The validity of the questionnaire set needs to be done to enable the questionnaire to achieve the research objectives.

RESULTS

In this study, a total of 283 respondents, consisting of Design and Technology (DT) teachers in primary schools in the state of Johor who have been teaching DT for 5 years and above, responded to the online questionnaire. Section B of the questionnaire included 43 items related to the 8 elements of digital competence. Table 1 shows the analysis of the mean and standard deviation of the respondents.

Table 1. Analysis of the mean and standard deviation of the respondents

Items	Mean	Standard Deviation (SD)	Interpretation
E1_Q6	3.57	.775	High
E1_Q7	3.58	.764	High
E1_Q8	3.38	.848	Moderate
E1_Q9	3.41	.772	High
E1_Q10	3.49	.760	High
E1_Q11	3.55	.719	High
Average of Mean and SD	**3.50**	**.773**	**High**
E2_Q12	4.00	.644	High
E2_Q13	3.98	.621	High
E2_Q14	4.00	.633	High
E2_Q15	3.66	.788	High
E2_Q16	3.94	.671	High
E2_Q17	3.92	.666	High
Average of Mean and SD	**3.92**	**.671**	**High**
E3_Q18	3.60	.679	High
E3_Q19	3.66	.752	High
E3_Q20	3.66	.747	High
E3_Q21	3.70	.714	High
E3_Q22	3.56	.757	High
E3_Q23	3.54	.749	High
Average of Mean and SD	**3.62**	**.733**	**High**
E4_Q24	3.47	.685	High
E4_Q25	3.45	.673	High
E4_Q26	3.40	.749	Moderate
E4_Q27	3.48	.764	High
E4_Q28	3.42	.761	High
E4_Q29	3.47	.769	High
Average of Mean and SD	**3.45**	**.734**	**High**
E5_Q30	3.60	.725	High
E5_Q31	3.59	.681	High
E5_Q32	3.65	.663	High
E5_Q33	3.65	.664	High
E5_Q34	3.58	.702	High
E5_Q35	3.64	.666	High
Average of Mean and SD	**3.62**	**.684**	**High**
E6_Q36	3.33	.750	Moderate
E6_Q37	3.35	.786	Moderate
E6_Q38	3.53	.731	High
E6_Q39	3.54	.725	High
Average of Mean and SD	**3.44**	**.748**	**High**
E7_Q40	3.30	.816	Moderate
E7_Q41	3.33	.823	Moderate
E7_Q42	3.63	.772	High
E7_Q43	3.29	.834	Moderate
E7_Q44	3.41	.787	High
Average of Mean and SD	**3.39**	**.810**	**Moderate**
E8_Q45	3.60	.705	High
E8_Q46	3.59	.690	High
E8_Q47	3.52	.778	High
E8_Q48	3.27	.989	Moderate
Average of Mean and SD	**3.50**	**.791**	**High**

From Table 1, it was found that Element 2, which is Digital Resources, has the highest mean score of 3.92 with a standard deviation of .67. This indicates that this element is the most dominant digital competence element among Design and Technology (DT) teachers in primary schools for online teaching and facilitation. Furthermore, Element 3, which is Digital Pedagogy, and Element 5, which is Empowering Students, both have a mean of 3.62, which is the second-highest mean score. Both elements are the second most dominant digital competence elements among Design and Technology (DT) teachers in primary schools for online teaching and facilitation.

Based on the analysis of the 43 items from the eight digital competence elements, Element 7, which is Digital Environment, has the lowest mean score of only 3.39. Although the mean score for Element 7 is low, the obtained mean score still falls within the range that suggests a moderate interpretation. This indicates that some teachers agree that their digital environment while teaching DT subjects is satisfactory. Element 1, which is Professional Engagement, and Element 8, which is Extrinsic Digital Commitment, both have a mean score of 3.50, which is the third-highest mean score. Furthermore, Element 4, which is Assessment, achieved a mean score of 3.45, and Element 6, which is Facilitating Students' Digital Competence, obtained a mean score of 3.44.

Overall, the average mean score for the elements related to teachers' digital competence is 3.56 with a standard deviation of 0.743. Element 2, Digital Resources, is the most dominant digital competence element among Design and Technology (DT) teachers in primary schools for online teaching and facilitation.

DISCUSSION/ CONCLUSION

The results of this study show that among Design and Technology (DT) instructors in elementary schools, Element 2, which is Digital Resources, is the most prevalent digital competency element for online teaching and facilitation. Teachers that possess digital competence can utilize digital tools and technology in the teaching and learning process. It includes a variety of abilities, know-how, and attitudes that let teachers make the most of digital resources to improve instruction and involve students in fruitful learning experiences. Redecker (2017) asserts that Element 2's focus on a key aspect of digital resources lies in the process of selecting, developing, modifying, and managing them. Additionally, ensuring the protection of personal data by the European Framework for Digital Competence of Educators (DigCompEdu) is another crucial aspect associated with digital resources. The DT teacher at primary school is ready to carry out online teaching and facilitation using YouTube, videos, and also learning management systems such as Google Classroom, Zoom, or Google Meet. The findings of this study are in line with the research conducted by Lapada et al., (2020). Online teaching and facilitation will assist in the implementation of learning sessions as technology can serve as a bridge for teachers to transfer knowledge to students, thereby making the learning process more meaningful. According to the study by Kuppusamy and Norman (2021), the use of online teaching and facilitation, technology can enhance the quality of teachers by producing innovative learning experiences that provide the best possible learning experience. Furthermore, online teaching and facilitation using various types of digital resources enhance autonomy in a student-centred collaborative learning environment. Moreover, the implementation of online teaching and facilitation can motivate students to learn and improve their performance.

The conducted study only involved primary school teachers in the state of Johor. The researcher suggests that this study can be extended to primary schools in other states in Malaysia so that the research findings can be used as a determinant for the upcoming changes by specific parties within the Ministry of Education Malaysia in identifying the digital competency of teachers, to plan suitable courses for teachers who have not demonstrated skills in this technology. Furthermore, future researchers are encouraged to

take a larger sample size than the previous study, so that the obtained research findings will be more accurate and realistic. From a prospective standpoint, the researcher suggests conducting further research using a mixed-methods approach to validate the DIGIGLO instrument in assessing teachers' digital competencies to assess the suitability of feedback. This is particularly important in obtaining individual feedback through interviews to identify potential ways to assist teachers in further developing their digital competencies.

In conclusion, the primary school DT instructors who participated in this study have acknowledged the significance of digital competence in their online teaching and facilitation efforts. Success in conducting online teaching and facilitation will depend on the teachers' capacity for innovation in the design and collection of materials, learning methods, and selection of the most appropriate applications based on topic and methodologies. Digital proficiency among instructors is essential for improving student learning, preparing students for the digital environment, customising education, encouraging creativity and innovation, and enabling ongoing professional development. It enables educators to make the most of digital technology's potential to give their students rich and lasting educational experiences. Because of this, DT instructors in primary schools need more specialised training to improve their abilities to deliver successful online learning.

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