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Navigating New Horizons: Challenges of Malaysian secondary school teachers in cultivating Digital Information Literacy (DIL) competencies through ICT-based projects in design and technology (RBT)

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Abstract
This study explores Malaysian secondary school teachers' challenges in integrating digital information literacy (DIL) into their teaching. The research focuses on Design and Technology (RBT), highlighting the need for students to navigate the digital information landscape. The study uses a qualitative phenomenological study and thematic analysis by Atlas.ti v23 to identify challenges in teaching ICT-based projects. The research suggests that innovative teaching methodologies, stakeholder collaboration, and a culture of adaptability are crucial for empowering teachers to cultivate DIL in students, enabling them to navigate the digital era confidently and competently.

Keywords: Challenges in teaching, ICT-based projects, digital literacy, digital information literacy, RBT

1.0 Introduction
With the development of technology and the widespread use of the internet, information access has become more accessible and convenient than ever before. In today's scenario, information is compulsory. Information literacy (IL), digital literacy (DL), and digital information literacy (DIL) are related ideas that involve the capacity to acquire, assess, and efficiently utilize information; however, they each concentrate on specific areas within the broader scope of the digital age (Leaning, 2019). DIL is an extension of IL and DL that focuses explicitly on navigating the complexities of the digital information landscape. It involves the skills needed to effectively find, evaluate, use, and ethically create information from digital sources. It consists of various skills and capabilities required to navigate the digital landscape, including searching for information online, critically evaluating sources, determining credibility, and using information ethically and responsibly. DIL goes beyond simple technical skills and involves higher-order cognitive abilities such as critical thinking, problem-solving, and effective communication in the digital realm (Hanbidge et al., 2015).

In today's digital age, DIL is becoming increasingly important for teachers to prepare students for the challenges and opportunities of the digital age (Starkey, 2020). The growing utilization of information and communication technology (ICT) in education has contributed to the emergence of DIL, making it crucial for students to have basic technological skills and be digitally literate. This integration poses various challenges and opportunities for secondary school teachers in Malaysia (Yunus & Suliman, 2014). Incorporating DIL and ICT-based projects into the curriculum requires teachers to acquire necessary skills and knowledge, such as proficiency in using technology and digital tools and understanding how to teach and assess digital information literacy skills. This integration allows teachers to create engaging and interactive student learning experiences (Raman et al., 2020).

ICT is crucial in education, particularly RBT subjects (Yusof et al., 2021). By incorporating ICT-based projects into RBT education, students can enhance their digital literacy, creativity, problem-solving abilities, and critical thinking skills through various opportunities, essential for success in the digital age and highly valued in the workforce (Nordin et al., 2020). These skills are also applied to real-world scenarios, enhancing students' understanding and application of design principles, technical skills, problem-solving, and creativity with digital technologies. ICT-based projects are pivotal in enhancing students' understanding of design principles and technical skills within RBT. These initiatives provide a unique platform for experiential learning by immersing students in dynamic, technology-driven projects. Through digital tools like Arduino software, scratch software, simulations, and multimedia presentations, students gain a tangible grasp of complex design concepts and technical intricacies, making them more ICT and digitally literate (Yunus & Suliman, 2014). This practical methodology encourages a more profound comprehension of design principles in real-life scenarios, preparing students to connect theoretical concepts with practical execution. Additionally, working with digital technologies refines students' technical skills in navigating software interfaces, modeling 3D objects, and comprehending the digital representation of physical structures. ICT-based projects serve as a transformative conduit for students to internalize design principles and technical competencies in an engaging, interactive, and long-lasting learning outcome.

Nomenclature

A	information literacy
B	digital literacy
C	digital information literacy
D	ICT-based projects
E	Design and Technology (Reka bentuk & Teknology – RBT)

Teachers need to possess good digital capabilities when teaching ICT-based projects in RBT. Teachers proficient in digital literacy are better equipped to guide and support students in their ICT-based projects (Cheok et al., 2020). They can effectively model and demonstrate the use of digital tools and software, provide technical troubleshooting assistance, and offer meaningful feedback on students' projects. In addition, digitally savvy educators can support students in conducting critical analysis and assessment of the information they come across while engaging in research and design activities. However, teachers face some challenges in applying digital information literacy skills in teaching ICT-based projects in RBT.

One of the challenges is the need for teachers to continually update their own digital skills and knowledge to keep up with rapidly evolving technology (Amhag et al., 2019; Jan, 2017). Another challenge is the availability of and access to technological resources. Some schools may not have sufficient technical infrastructure or equipment to support ICT-based projects in RBT. Furthermore, not all students may have equal access to devices and reliable internet connections at home, which can hinder their ability to engage fully with the ICT-based projects assigned in class (Ferri et al., 2020). Therefore, in this paper, the researchers aim to explore the challenges Malaysian secondary school teachers face in developing DIL through ICT-based projects in RBT.

2.0 Literature Review

According to a Copriady study (Dharma et al., 2020), teachers encounter difficulties and challenges when implementing ICT use in the teaching and learning process. Negative attitudes towards ICT utilization and a lack of knowledge and skills to effectively use ICT were identified as two major obstacles. Furthermore, ICT integration in education aims to meet the needs and language levels of students, foster creativity among teachers, enhance access to teaching resources, promote collaborative work, cultivate a positive attitude towards learning, and support students in the learning-teaching process. However, teachers are still not fully ICT literate and do not use ICT in their teaching, which deprives students of the benefits of technology integration in the classroom (Dharma et al., 2020). Indeed, the obstacles faced by teachers in implementing ICT-based learning are substantial.

2.1 Teachers' Challenges

Limited access to technology poses a significant challenge for teachers striving to develop digital information literacy through ICT-based projects in RBT (Krumsvik et al., 2016). This challenge arises from the availability of technological resources within schools and outside of school, particularly in rural or underserved areas. Internet access in schools may be slow or unreliable, making it difficult for students to access online resources and collaborate on digital projects. Additionally, not all students have equal access to devices and reliable internet connections at home, further hindering their engagement with ICT-based projects outside of school. Teachers' lack of digital utilization skills is another obstacle to developing DIL through ICT-based projects (Perifanou et al., 2021). Not all teachers are digitally literate and may feel overwhelmed or unprepared to incorporate technology into their teaching practices. Senior teachers may struggle with adapting to new technologies, as they may have been trained in outdated methods and tools during their school years. Some

teachers might not possess the necessary digital skills to effectively use and teach ICT tools (Essuman et al., 2022). This lack of confidence in using technology could reduce integration efforts, limiting students' exposure to the benefits of ICT-based projects.

Essuman et al. (2022) also add that time constraints are another critical challenge to adopting technology in education. Teachers often face time limitations due to a demanding curriculum and increased workload, making it difficult to allocate sufficient time for incorporating ICT-based projects into their teaching practices. This can result in missed opportunities for students to develop digital information literacy skills through engaging and interactive ICT-based projects. Aligning ICT integration with existing curricular objectives can also prove complex, potentially causing a disconnect between the technology-driven projects and the overarching learning goals. Integrating ICT into teaching and learning environments can be significantly impeded by resistance to change (Dharma et al., 2020). Teachers, especially senior teachers, should be open-minded and willing to embrace new technologies and instructional methods. Change resistance can arise from fear of the unknown, lack of confidence in technology use, and a perceived disruption to established teaching practices. One of the key challenges in applying DIL skills in teaching ICT-based projects in RBT learning environments is the fast-paced nature of technological changes (Henderson & Corry, 2021; Raman et al., 2020). Teachers often feel overwhelmed by the constant technical updates and upgrades, making it challenging to keep up with the latest tools and applications that can enhance their teaching strategies (Pardaboyevich et al., 2020). However, teachers must embrace these technological changes and view them as opportunities for improving teaching and learning rather than obstacles.

3.0 Methodology

Research methodology is comparable to a roadmap that helps researchers conduct their studies and attain their research goals. It refers to the systematic approach or framework researchers follow when conducting a study or investigation. The method used in this study is a qualitative methodology with a phenomenological study design. According to van-Manen (2017), in phenomenology, researchers explore the lived experiences of individuals who have gone through a particular phenomenon (Labraña & Wilhelm, 2007). A desk review is essential in research because it analyzes existing literature (Duan & Da Xu, 2021). This procedure assists researchers in gaining a thorough understanding of the research subject, pinpointing areas where knowledge is lacking, and guiding the formulation of research inquiries and goals. Hence, the phenomenological study design is appropriate for this research as it aims to explore teachers' lived experiences and understand their perspectives regarding the challenges and strategies of ICT integration in teaching and learning.

3.1 Data Collection

Semi-structured and in-depth interviews are the primary data collection methods used in this study to gather rich and detailed information from participants where they could freely express their experiences, perspectives, and insights regarding the challenges and strategies of ICT integration in teaching and learning (Zayyadi et al., 2019). Seven RBT teachers were interviewed in this study, ensuring diverse perspectives and experiences. The teachers teaching Form 2 RBT were purposefully selected because they have experience integrating ICT tools and strategies into their teaching practices.

The Google Meet platform is utilized for interviews, allowing virtual interactions with the participants besides geographical issues (Opara et al., 2023). The researchers collaborated with the teachers to identify the problems in the learning process and then found alternative solutions. The data obtained from interviews was transcribed and then analyzed thematically using a coding procedure. The themes from the data analysis provide a comprehensive understanding of teachers' challenges in integrating ICT into the teaching process and the methods they use to address these difficulties.

The respondents also used teachers' daily journals to supplement the interview data. These journals provided additional insights into their experiences with ICT integration daily and served as a valuable source of secondary data for the study. Document analysis from teachers also provided additional insights into the resources and materials used in ICT integration, further enhancing the study's findings. Supporting data gathering method: the student learning product, where student learning products, such as assignments and projects, were assessed to gauge the impact of ICT integration on student outcomes. Ultimately, combining interviews, daily journals, document analysis, and student learning products allowed for a comprehensive understanding of the challenges and strategies related to ICT integration in teaching and learning (Wagiono et al., 2022)

3.2 Data Analysis

The data collection is analyzed using Atlas.ti v23 software allows for the organization, coding, and analysis of qualitative data (Zairul, 2021). Thematic analysis was conducted to identify common themes and patterns in the data, which were then used to develop a comprehensive understanding of the challenges and strategies related to ICT integration in teaching and learning (Braun & Clarke, 2006). The thematic analysis included categorizing and analyzing the data to identify repetitive themes and patterns associated with the obstacles and approaches to integrating ICT. Figure 1 presents the flowchart of the research design for this study.
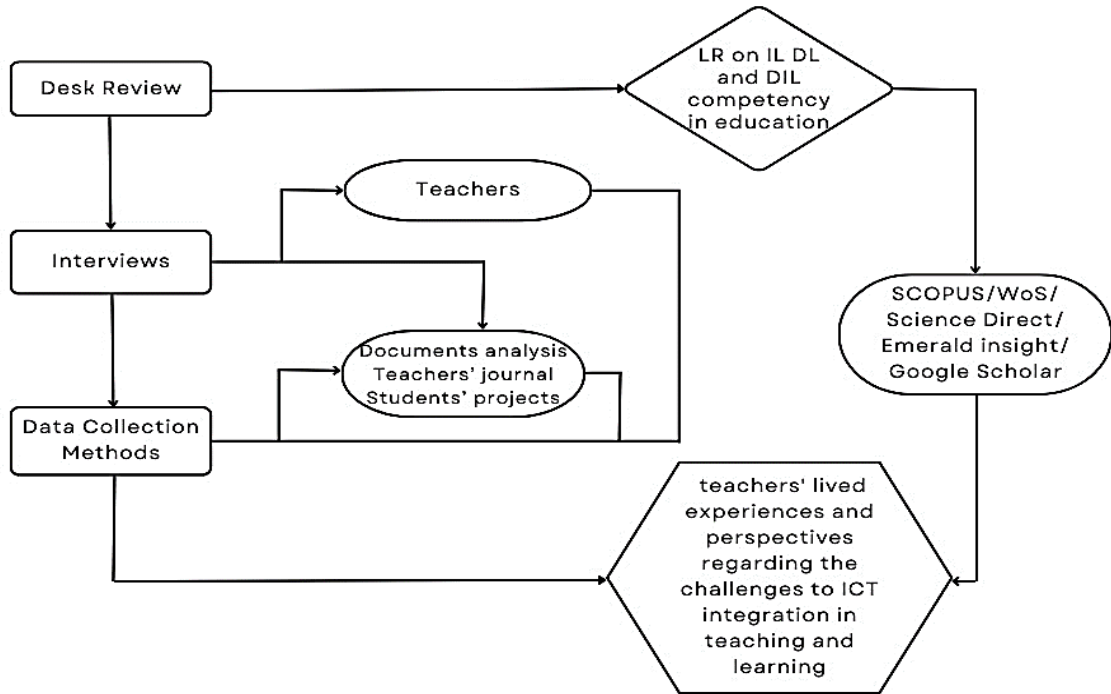
Figure 1: The flowchart of the research design for this study

4.0 Findings

The findings of this study identified several themes for the key challenges faced by teachers in ICT integration. Figure 2 presents a visual representation of the themes derived from the literature review, which was extracted from Atlas.ti v23.
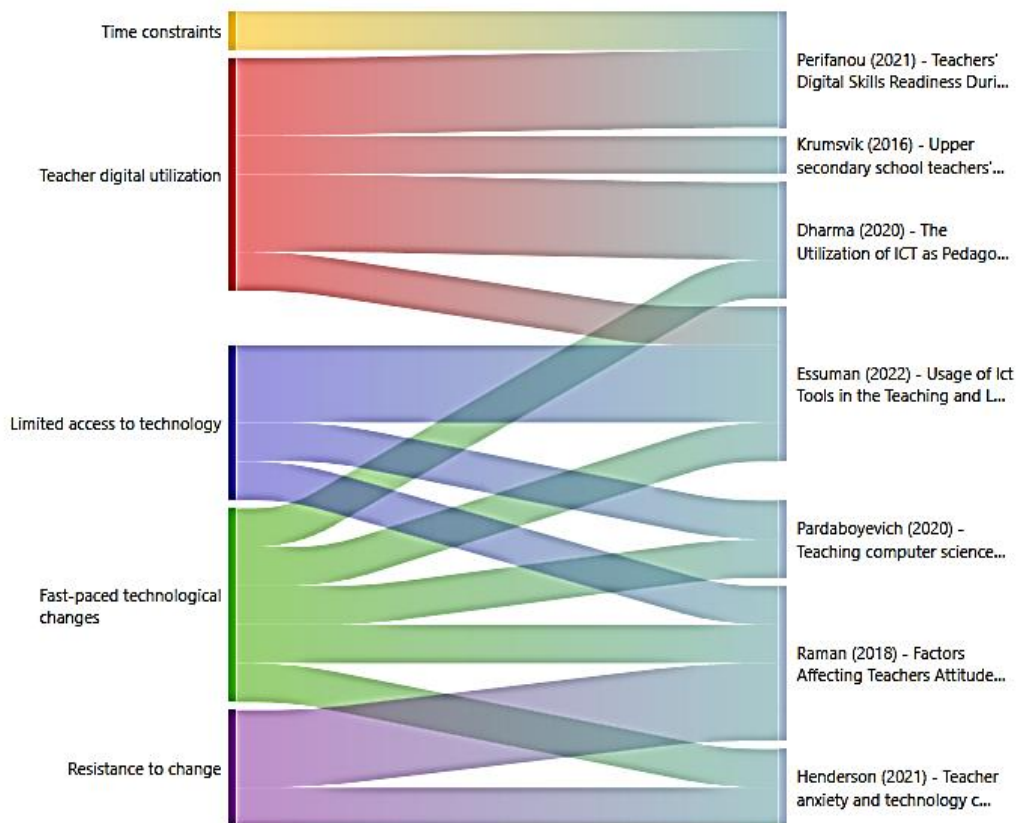

Figure 2: Sankey graph extracted from Atlas.ti v23.

4.1 The Challenges and the Strategies to Overcome

Teachers often face several challenges when applying DIL skills to teaching ICT-based projects. These challenges can impact the effectiveness of integrating DIL into the classroom. Based on the literature review the findings highlighted several key challenges that teachers face when teaching ICT-based projects in their teaching practices. According to Table 1, the challenges identified include limited access to technology, time constraints for teacher digital utilization, resistance to change, and fast-paced technological change which are related strategies to overcome.

Table 1. Challenges and strategies to overcome.

Challenges	Strategies to Overcome
Limited Access to Technology	Advocate for improved technology access and resources within the school.
	Explore alternatives, such as partnering with local libraries or using students' personal devices.
Teacher Digital Utilization	Participate in professional development workshops to enhance digital skills.
	Seek guidance from tech-savvy colleagues or mentors for support.
	Take online courses or tutorials to build confidence in using digital tools.
Time Constraints	Prioritize digital information literacy skills as a critical component of 21st-century education.
	Identify opportunities to embed these skills within existing projects and coursework.
Resistance to Change	Highlight the benefits of digital information literacy skills to colleagues, administrators, and students.
	Provide evidence of the positive impact on student learning and preparedness for the digital world.
Fast-Paced Technological Changes	Stay updated with technology trends through educational resources, blogs, and news sources.
	Engage in continuous learning and attend workshops or conferences on digital advancements.

5.0 Discussion

This discussion delves into the specific challenges faced by Malaysian secondary school teachers and offers strategies to overcome them, including limited access to technology, teacher digital utilization, time constraints, resistance to change, and fast-paced technological changes. Cultivating DIL through ICT-based RBT projects in Malaysian secondary schools is a dynamic initiative fraught with challenges. By recognizing and actively addressing the unique obstacles faced by teachers in this context, a more conducive learning environment can be created. Through advocacy, professional development, strategic time management, adaptability, and a commitment to staying current, teachers can overcome these challenges and empower their students with essential DIL skills for the digital era. This collective effort lays the foundation for a more technologically adept and digitally literate generation of students in Malaysia.

This study emphasizes the importance of recognizing and actively addressing teachers' unique obstacles in the Malaysian context to establish a more favorable learning environment. It also suggests teachers can tackle these challenges through advocacy, engaging in professional development, practicing strategic time management, fostering adaptability, and committing to staying current with the evolving technological landscape. The goal is to empower students with essential DIL skills suitable for the digital era. Based on a phenomenological study that interprets the experiences of Malaysian secondary school teachers, it is evident that integrating ICT into teaching practices presents various challenges. It also shows that the phenomenological study provides valuable insights into the barriers and enablers of ICT integration in teaching practices, leading to the development of a conceptual model and recommendations for improvement in the Malaysian education system (Habibi et al., 2020). A more comprehensive understanding of the challenges and strategies can be gained by exploring teachers' experiences and perspectives on ICT integration initiatives in their professional lives. This comprehension can guide the creation of more efficient strategies and support systems to improve the incorporation of ICT into teaching methods.

6.0 Conclusion & Recommendations

In the end, it was found that a qualitative approach with a phenomenological study design was the best way to find out about and understand the problems and solutions related to integrating ICT-based projects into teaching and learning. The study revealed that teachers encounter various challenges in applying digital information literacy skills when teaching ICT-based projects in their teaching practices, such as limited access to technology, teacher digital literacy time constraints, resistance to change, fast-paced technological changes, and assessment challenges. However, this study has limitations, including a compact sample size and restricted geographic coverage. Therefore, future research could employ a larger sample size and extend the geographical scope to understand better the

challenges and potential solutions in integrating ICT into teaching practices. This study extends beyond RBT subjects and can be applied to other subject areas.

To address these challenges, it is recommended that educational institutions provide teachers with adequate training and support in digital information literacy skills. This will enable teachers to effectively integrate ICT tools and resources into their teaching practices. Additionally, educational institutions should allocate sufficient resources to ensure access to technology and provide ongoing professional development opportunities for teachers to enhance their digital literacy skills. This study also recommends future research to explore the impact of these strategies on student learning outcomes and engagement. This study also suggests that future research should examine the role of organizational factors such as leadership style, supervisory support, and organizational culture in promoting readiness for change and innovative work behavior in the context of ICT integration in teaching and learning. The other researchers can build upon this study by conducting quantitative research to further explore the impact of digital information literacy skills on teaching practices and student outcomes.

Acknowledgments

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