Teachers' Digital Information Literacy (DIL) Competencies in Teaching ICT-Based Projects: Malaysian Secondary Schools Teachers' Experience

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Abstract. In contrast to the fast growth of information and communication technologies (ICT) in 21st-century learning, digital information literacy (DIL) changed much. Even though there have been efforts to promote DIL, there is still a lack of knowledge about how it should be created and used in schools. Although understanding DIL competencies is a key skill for lifelong learning, it is still hard to teach. The primary objective of this study is to conduct a comprehensive review of recently published literature. The aim is to gain a nuanced understanding of the extent of knowledge possessed by teachers in select Malaysian secondary schools pertaining to the pedagogy of instructing ICT-based projects within the domain of design and technology, specifically denoted as "Reka Bentuk dan Teknologi" (RBT). The methodology employed for this study involves an exhaustive analysis of existing literature. Through a meticulous and systematic exploration of articles spanning diverse online databases, a curated selection of pertinent materials was identified and subsequently incorporated into the study. As the findings of this investigation emerged, a series of interrelated factors that interconnect ICT-based projects with the realm of DIL were discerned. These findings contribute to the broader understanding of how DIL can be synergistically integrated with the pedagogical approach of RBT, shedding light on the strategies, challenges, and potential avenues for enhancing DIL competencies in the context of contemporary education. This study serves as a steppingstone towards bridging the gap between technological advancements and the development of essential digital literacy skills, fostering a more holistic and effective approach to education in the digital age.
Keywords: Design and Technology (RBT), digital information literacy (DIL), DIL competencies, ICT-based projects, lifelong learning, information management.

1   Introduction

Information and communication technology (ICT) has become more common in education over the past few years. As a result, enhancing teachers' digital information literacy (DIL) competencies has become critical to ensuring that they can effectively integrate ICT into the teaching of various subjects (Wu et al., 2023). Technology has become an essential part of our personal, academic, and working lives today. Just like in other sectors, ICT applications in education have become increasingly important in recent years (Scherer et al., 2015; Tirziu & Vrabie, 2015). Nevertheless, nothing prepares us for the sudden emergence of the COVID-19 outbreak in late 2019. Kaden (2020) mentions the pandemic has completely altered normal school education practices. With most people being separated from each other during lockdown orders, schools have no choice but to completely rely on technology for class instructions. In Malaysian educational system, digitally literate teachers are seen as a crucial component in teaching ICT-based projects (Hoque et al., 2012). The Malaysian government's emphasis on teachers' digital competencies in teaching ICT-based projects is a recognition of the fundamental role that technology plays in enhancing learning outcomes for students (Khan et al., 2022). In today's information-rich and technologically advanced society, teachers play a pivotal role in equipping students with the skills necessary to critically evaluate, use, and create digital information effectively. Yadav et al. (2015) state that as teaching methodologies evolve to incorporate digital tools and resources, it becomes imperative for teachers to possess a comprehensive set of DIL competencies. This is especially true in the context of teaching ICT-based projects in Malaysian secondary schools, where the integration of technology is becoming increasingly prevalent.

Information Literacy and Digital Literacy

Before delving into the specifics of DIL, it's crucial to understand the relationship between information literacy (IL) and digital literacy (DL). IL encompasses the ability to locate, evaluate, and use information from various sources, ensuring its relevance and credibility (Yu et al., 2016). On the other hand, DL extends beyond information to encompass the ability to effectively navigate digital tools, platforms, and technologies (Meyers et al., 2013). DL includes skills related to using software, understanding online security, and utilizing digital resources for various purposes.

Digital Information Literacy: The Convergence

DIL represents the convergence of these two essential literacies. It involves the ability to not only access and evaluate information effectively but also to do so within a digital context (Gündüzalp, 2021). This encompasses skills such as efficiently searching for information online, critically assessing the credibility of digital sources, and ethically using and citing digital information. In the context of teaching ICT-based projects, teachers need to possess a solid foundation in DIL to guide students in utilizing digital resources for research, collaboration, and project creation (Asadullah, 2014). Therefore, for students and teachers to succeed in the digital age, both IL and DL competencies are essential. The integration of ICT in the Malaysian education system has

led to a growing importance placed on teachers' DIL competencies. The Malaysian
government recognizes the pivotal role of technology in enhancing learning outcomes
for students and, as such, emphasizes the need for teachers to become digitally literate
to deliver quality education (Lateh & Muniandy, 2010). Henceforth, in the 21st century,
knowledge-based citizens need to master both IL and DL skills to remain competitive
and relevant today (Noerjanah & Maulidah, 2021; Sadaf & Johnson, 2017). These two
skills can be conveniently combined to become DIL skills. Students and teachers need
to have these skills to use ICT in education successfully.

Students are depending more on digital resources for their studies (Dahlström &
Damber, 2020). They struggle to manage digital resources, as the latter need different
handling compared to printed materials. Students need to efficiently search, select, eval-
uate, and analyze digital information before they can use it (Ben-Yehudah, 2018; Hi-
dayati, 2023). Furthermore, the acquisition of these skills is not only imperative for
students but also for teachers. Gündüzalp (2021) adds that teachers are better equipped
to become digitally literate to teach and support students in acquiring DIL competencies
in their teaching and learning process. This has necessitated the need to develop DIL
competencies in schools.

It is therefore very important for teachers to help the students improve their DIL
skills (Khatun, et al., 2015), and DIL education should start by having teachers who are
competent in DIL skills themselves. Thus, to equip students with the necessary skills
for success in the digital age, teachers need to provide comprehensive DIL competen-
cies that supports their mastery of digital and information literacy skills (Meyers et al.,
2013). As such, it is essential to prioritize the integration of DIL education into the
school curriculum and equip teachers with a sufficient level of competency in digital
information technologies and literacies (Birgin et al., 2020; Napal Fraile et al., 2018).
Additionally, it is important to evaluate the effectiveness of DIL competencies and re-
fine them as necessary to ensure that teachers are equipped with the skills necessary to
teaching in the digital age.

2   ICT-based Projects

2.1 Design and Technology (Rekabentuk dan Teknologi - RBT)

Education systems across the world acknowledge the fact that teachers are the back-
bone of schools and are accountable for system-wide implementation (Hattie, 2009;
Hargreaves & Fullan, 2012). This supports the wider use of ICT in classrooms with the
goal of developing ICT skills throughout the whole teaching profession. One of the
most convenient platforms to teach DIL is through ICT-based projects. The nature of
project tasks that require students to use ICT and other soft skills to work on their tasks
has made it the most convenient approach to integrate DIL education (Khatun et. al.,
2015). Students naturally apply DIL skills to access and utilize e-resources for their
project. In Malaysia, The Malaysian Education Development Plan 2013–2025 (PPPM)
has introduced a new ICT-based project in secondary schools starting from secondary
1 in 2017 based on "secondary school integrated curriculum" or KSSM (Revise), 2017.
The project is locally known as *Reka Bentuk dan Teknologi* (*RBT*) or Design and

Technology, with the aim to produce creative and critical thinking students, (MOE, 2016). The MOE is hopeful that the project experiences will help students to acquire a global mindset and better understanding of cutting-edge technology. The authentic and problem-based learning nature of the RBT project provides good opportunities for the students to develop their DIL skills, under the supervision of the teachers.

Form 1-3 RBT is a continuation of the RBT subjects that have been introduced to students in Level II of primary school (MOE 2016). RBT in secondary schools to re-place the Integrated Life Skills subject in secondary schools, which was introduced in 1989. RBT is an elective subject that emphasizes design in the production of technol-ogy-based products. It aims to produce students who can work on producing simple and meaningful products (MOE 2016). As discussed in "New KSSM" (2016) the KSSM RBT Curriculum and Assessment Standard Document was written for three years of schooling, from level 1 to level 3. This document covers civil, electrical, electronic, mechanical, household science, agricultural science, and financial management. Throughout schooling, students are exposed to theoretical and practical learning in ex-isting workshops. Teaching and learning activities will emphasize students' mastery of all areas of the RBT curriculum. The RBT Standard Curriculum is designed to enable students to acquire the knowledge and skills needed to gain information about the fields they are interested in and want to study at a higher level ("New KSSM", 2016).

The RBT project educates the students on design criteria and how to integrate tech-nology to produce learning products. The project encourages students to think crea-tively about designing products that meet human needs by integrating design and tech-nological skills. Among the goals of RBT are: (1) Acquire skills in using appropriate equipment, materials, and computer software in producing a product, (2) Decide to solve a problem using appropriate technology, (3) Design through the design cycle ap-proach and create projects effectively and (4) Develop products through a design pro-cess that uses technology, (BPK, 2016). It is hoped that through product design and manufacturing activities, students will put their knowledge and abilities into practice. The RBT project focuses on four learning areas as described in Table 1:

Table 1: The four learning areas of RBT

AREAS	DESCRIPTION
Design Appreciation	Be grateful and appreciate a design around for the purpose of design improvement or making a new design better, cheaper, and more efficient.
Technology Application	Study and apply technology in design that covers a wide range of disciplines.
Product Manufacturing	Production of more efficient designs and products that involve the design process.
Product Design Evaluation	Emphasizing the noble values in learning to en-sure that the product can solve the problems of in-dividuals and society as well as competitive

It is interesting to note that the RBT project emphasizes learning components that
are relatable to DIL skills. The RBT syllabus is trying to develop the same set of skills
as those under the umbrella of DIL as shown in Table 2. Hence, it is hypothesized that
the RBT project is one of the most appropriate platforms to develop students' DIL
skills.

Table 2: Relationship between RBT Areas and DL Skills

Digital Literacy Skills (DL skills components, Hague & Payton, 2010)	RBT Areas (KSSM RBT four areas, BPK, 2016)
Creativity	Design Appreciation
Critical thinking and evaluation	Product Manufacturing
Culture and social understanding	Product Design Evaluation
Collaboration	Technology Application
Effective communication	Product Manufacturing
e-safety	Technology Application
The ability to find the select information	Design Appreciation
Functional skills	Product Design Evaluation

To ensure that students get the DIL skills they need, the RBT project should put
more emphasis on how teachers can help students learn the skills. RBT is a project that
uses digital technologies to teach DIL skills to students. Through this project, teachers
help students learn about digital and information literacy by giving them structured
chances to find, analyze, and evaluate digital resources (Arman et al., 2020). The study
by Sabado, (2018) shows that DIL skills need to be integrated through teaching and
learning activities, such as project work. They need to redefine their roles, as well as
those of their students, in everyday classroom practices to create a more innovative
teaching style (Rohatgi et al., 2020). In summary, the growing demand for DIL skills
necessitates the need to equip students with these competencies from an early age. This
means that DIL education needs to be a big part of the school curriculum, that current
programs need to be evaluated and improved, and that teachers need to know enough
about digital technologies and information literacy to help students learn DIL skills
(Osmanovi et al., 2021; Parmin & Khusniati, 2021). Teachers are expected to teach
students how to search for and handle information, as well as master other ICT-related
abilities.

By doing this, students will be ready for the digital age and will be able to do well
in a variety of situations. Both teachers and students need to get training and help on a
regular basis to stay up to date on new digital technologies, new knowledge platforms
like social media, and other digital tools that may change the way people use infor-
mation. As a start, teachers' competencies are critical in transferring DIL and higher
order thinking skills (HOTS) (Binoya, 2021). So, teachers need to put DIL education
at the top of their to-do lists. This will give students the skills they need to succeed in
today's digital society. Overall, DIL education needs to be part of the school curriculum
to give students the skills they need to be successful in the digital age (Tso et al., 2022).

This means that teachers need to change the way they teach, rethink their roles in the classroom, and learn enough about digital technologies and how to use information (Khalilia et al., 2021). However, educational institutions, policymakers, and other stakeholders must support this transformation by giving teachers the tools they need to develop DIL skills in their students (Olenik-Shemesh et al., 2019). This will make sure that both teachers and students are up to date on new digital technologies, new knowledge platforms like social media, and other digital tools that may change the way people interact with information (Rahmi & Cerya, 2020). This means that the teachers' abilities to transfer their skills have a significant impact on the success of students' skill development.

2.2 Problems

Teachers play a crucial role in transmitting knowledge and skills to students. DIL skills are important in 21st century learning and need to be integrated into current teaching and learning (Sabado, 2018). Teachers owns mastery of DIL skills is important to ensure successful integration of skills during the teaching and learning process. Despite the rising focus on DI and IL that makes a complete set of DIL in educational policies, many teachers believe they are still unprepared to assist their students in achieving the skills (Sadaf and Johnson, 2017). The RBT project is a new elective subject in the Malaysian school curriculum. It was introduced in 2017 and has been implemented for six years now. To date, not much is known about how successful this project is in achieving its objectives, particularly with regards to producing DIL-literate students. There is no known research that studies the effectiveness of this project to develop critical, creative, and ICT-based skills in students, all of which are elements of DIL skills. There is still no standardized curriculum to teach IT and design-based projects and a lack of necessary technical pedagogy (Lee and Tsai, 2010; Rafi et al., 2019). Even though the MOE claims IL (Mohamad, 2002, cited in Ismail, 2014) and DL are already included in the curriculum, DIL is still in its infancy stage in Malaysia (Sazali et al., 2021).

3   Methodology

This method involves conducting a comprehensive and exhaustive analysis of existing literature to deepen researchers' understanding of the topic and identify any gaps or inconsistencies in current knowledge (Vaismoradi et al., 2016). Snyder (2019) mentions that the literature review approach is a valuable method for gathering information and synthesizing research results to provide evidence on a meta-level. By conducting a literature review, researchers can gain insights into previous studies, theories, and concepts related to their research topic.

In the context of design and technology education, numerous studies have explored the integration of Information and Communication Technology (ICT) within classroom projects. For instance, Bond and Bedenlier (2019) conducted a comprehensive review of the literature focusing on the role of ICT tools in enhancing student engagement and learning outcomes during design and technology projects. Their findings highlighted the potential benefits of using digital resources to foster creativity and problem-solving

skills among students. Recent research by Rafi et al. (2019) and Enrique Hinostroza
(2018) delved into the relationship between ICT-based projects and digital literacy and
information literacy within the teaching and learning process. Their study investigated
how teachers embed the DL and IL principles while guiding students through the crea-
tion of digital prototypes. They found that effective integration of DIL skills, such as
evaluating online sources for authenticity, enriched students' ability to make informed
design decisions (Schwenger, 2016).

However, despite the growing interest in ICT-based projects and DIL integration,
there appears to be a gap in the literature regarding the specific strategies employed by
teachers to seamlessly incorporate DIL principles into their instructional practices
(González-Pérez & Ramírez-Montoya, 2022). While existing studies have highlighted
the importance of DIL in the digital age, few have provided detailed insights into the
practical approaches that teachers adopt within education (McKnight et al., 2016;
Voogt et al., 2013). To address this gap, the current study seeks to explore the lived
experiences of design and technology teachers as they navigate the intricate relationship
between ICT-based projects and DIL (Drossel & Eickelmann, 2017).

In summary, the existing literature highlights the importance of ICT-based projects
and digital information literacy in education. However, there are gaps in knowledge
regarding the practical methods that teachers employ to effectively integrate DIL com-
petencies into their teaching strategies. This review informs the research questions and
aims of the current study, which seeks to contribute to a broader understanding of how
DIL can be integrated into teaching practices within the context of ICT-based projects.

4   Findings and Discussions

Factors relationship between ICT-based projects and teachers' DIL competencies

Information and communication technology (ICT) is being used more and more in
education, so it's important to think about how it affects DIL in the classroom. Although
ICT-based projects have been shown to be effective in enhancing students' learning
outcomes, these projects also require a certain degree of DIL competencies for teachers
to make their students to be successful (Dovie et al., 2019). Upon analyzing the data,
several key findings emerged regarding the integration of DIL principles within ICT-
based projects in RBT. This relationship highlights how teachers' competencies in DIL
play a critical role in effectively integrating ICT into their teaching, particularly when
guiding students through projects that involve the use of digital tools and resources.
The findings revealed that teachers who possess strong DIL competencies are more
likely to foster a student-centered learning environment, promote critical thinking and
problem-solving skills, and enhance students becoming digitally literate (Turabik &
Gün, 2016; Wu et al., 2023). Here's a breakdown of the factors related to ICT-based
projects and DIL competencies in teaching, presented in Table 3 based on a few litera-
tures:

Table 3: Factors related to ICT-based projects and DIL competencies in teaching.

Factors	Description
ICT-Based Projects	- Educational activities integrating technology. - Utilize digital tools, online resources, and platforms. - Aim to engage students and enhance learning outcomes. - Give students a chance to collaborate with each other as they share information and ideas
Digital Information Literacy (DIL) Competencies	- Ability to access, evaluate, and ethically use digital information. - Enable students to be creative and come up with new ways to present their ideas. - Critical thinking for online information. - Understanding digital ethics and copyright.
Integration in Teaching	- Teachers incorporate ICT projects into lessons. - Emphasize DIL principles alongside technological skills. - Promote critical analysis of online information.
Role of DIL Competencies	- Teachers guide students in finding credible online sources. - Teach critical evaluation of digital content. - Emphasize ethical use of digital resources.
Impact on Learning Outcomes	- DIL integration enhances critical thinking skills. - Equips students for responsible digital citizenship. - Improves ability to evaluate online information.
Pedagogical Strategies	- Techniques for teaching DIL alongside ICT projects. - Methods for fostering critical evaluation skills. - Promoting collaborative and ethical digital practices.
Teacher Training	- Professional development for DIL skills. - Training on incorporating DIL in ICT projects. - Strategies to enhance teachers' DIL competencies.
Challenges and Solutions	- Challenges in balancing technology and DIL. - Addressing misinformation and online bias. - Strategies to overcome DIL-related obstacles.

This table highlights the key factors related to the integration of ICT-based projects and teachers' DIL competencies in teaching, particularly within the context of Malaysian secondary school teachers' experiences. Teachers' DIL competencies enable them to effectively guide students through ICT-based projects, fostering critical thinking, communication and collaboration creativity and innovation, digital discernment, and responsible information use (Papadimos & Stawicki, 2021), Tarigan and Liana (2018) agree with students can also be creative and come up with new ways to present their ideas because they can use different media formats.

One of the DIL competencies is media literacy. Using media literacy in the classroom can be a great way to connect ICT-based projects and DIL (Pang et al., 2015; Siahaan & Gunawan, 2021). In this project, students can learn to use social media tools to communicate with others and share information. They will also need to know how to be good digital citizens and how to act ethically online. Through it (media literacy),

students enable to make websites, giving multimedia presentations, and communicating
through social media can help develop DIL in teaching by giving students the skills
they need to find, evaluate, and use digital information effectively and responsibly in
their schoolwork.

Incorporating data analysis projects can also be a way to connect ICT-based projects
and DIL. (Kurniawati & Hasyim, 2021) In this project, students can use digital tools to
collect and analyze data and learn how to present and talk about their findings. Moreo-
ver, this project can help students improve their critical thinking and problem-solving
skills as they learn to understand and draw conclusions from data. Data analysis projects
can help connect ICT-based projects and DIL (Zhang et al., 2021). By doing this, they
not only learn more about how to use digital information, but they also improve their
academic rigor by getting better at analysis and critical thinking. (Li & Zhao, 2019)
However, it is important for teachers to guide and help students throughout the data
analysis process to make sure they use reliable sources and analyze the data correctly.

Hence, teachers' DIL competencies enhance their ability to support students in ac-
cessing and evaluating digital resources, promoting information literacy and digital cit-
izenship skills. The relationship between ICT-based projects and DIL competencies in
teaching is symbiotic. This relationship ultimately contributes to enhanced student en-
gagement, learning outcomes, and preparation for active participation in the digital
world.

5   Conclusions and Recommendations

The DIL competencies for teachers' perspectives in teaching ICT-based projects de-
veloped in this article reported issues involving teacher challenges in readiness, comfort
level with technology, and the need for ongoing professional development. These com-
petencies serve as a launching point for the development of effective professional de-
velopment programs and strategies to help teachers build their skills and confidence in
using digital tools and resources. It is essential for teachers to possess DIL competen-
cies to effectively teach ICT-based projects. The digital age demands that teachers pos-
sess DIL competencies. By meeting this demand, we can ensure that students receive a
high-quality education that will prepare them for success in the modern world.

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