STEM TEACHER DIGITAL LITERACY: RELATIONSHIP BETWEEN DIGITAL LITERACY AND TECHNOLOGY INTEGRATION IN TEACHING AND LEARNING POST COVID-19

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ABSTRACT

Background and Purpose: The purpose of this study is to investigate STEM teachers' digital literacy and technological integration skills. The willingness of teachers to implement new teaching methods is one of the most important determinants of educational success. Engagement, confidence, curiosity, and comprehension of integrated STEM disciplines will increase as a result of indirect STEM integration teaching experiences. Therefore, it is essential to conduct research on STEM teachers' digital literacy knowledge since it is believed that STEM education, which focuses primarily on Science, Technology, Engineering, and Mathematics, involves complex science and engineering practices.

Methodology: 150 teachers in STEM subjects from Kuala Terengganu were randomly selected to participate in the study using a simple and stratified random selection method. The data was collected using a questionnaire with five sections: respondent information, comprehension of digital tools, communication and collaboration, creation of digital content, security, problem-solving, and technology integration. Correlation and linear regression were used to analyse the data.

Findings: Based on the findings, the level of digital literacy knowledge after COVID-19 was moderately high. In addition, there is a correlation between STEM teachers' digital literacy knowledge and their technology integration. It is estimated that STEM teachers’ knowledge of digital literacy influenced approximately 47% to technology integration.
Contributions: This study's findings may be beneficial for identifying the digital literacy challenges teachers in STEM fields confront post-Covid-19. Future research can therefore emphasize the identification and development of effective educational materials and programmes for STEM teachers, as well as the integration of technology into teaching and learning, in order to further develop the digital literacy of STEM teachers.

Keywords: STEM teacher, digital literacy, knowledge, technology integration, Covid-19.


1.0 INTRODUCTION

During the COVID-19 pandemic, STEM teachers have utilised a variety of technologies, particularly digital resources, for teaching and learning. Technology is an important component of STEM education, and technology is a great tool for modifying the natural world to meet societal needs and desires. According to Halim (2018), the goal of STEM education is to cultivate each student's capacity to meet the needs of the STEM industry, and this is an ongoing process. Due to the emphasis on STEM, the Ministry of Education (MOE) is now considering the recommendations of the National Education Blueprint (PPPM) 2013–2015 thoroughly. In light of concerns regarding the significance of STEM, particularly in education, it is necessary to cultivate more qualified and competent STEM employees to meet the nation's needs.

The two-year pandemic outbreak of COVID-19 affected all sectors in Malaysia, particularly education. It has had a significant impact on education systems, affecting approximately 1.6 billion pupils in over 200 countries and regions for the first time in human history (Pokhrel & Chhetri, 2021). However, the COVID-19 pandemic has allowed us to forge new paths towards a full embrace of digital learning. Due to the disruption, STEM teachers have adapted to online instruction and learning. As a consequence of the closure of all schools in Malaysia to combat the global pandemic, students, parents, and educational institutions throughout Malaysia have experienced the unanticipated spread of the COVID-19 epidemic. While schools and universities have been closed as a result of the pandemic, e-learning resources have been essential for facilitating student learning (Subedi, Nayaju, & Subedi, 2020). Online learning also allows students with physical disabilities greater latitude to interact
with the virtual environment while learning, requiring minimal physical movement (Basilaia & Kvavadze, 2020).

In order for educators, particularly STEM teachers, to be able to implement relevant STEM instruction despite the outbreak, they must be knowledgeable and accepting of information and communication technology (ICT). For example, current online platforms include Microsoft Teams, Google Classroom, Canva, and Blackboard, which offer unified communication and collaboration tools. The aforementioned resources enable educators to design educational courses, training sessions, and skill development programmes. These tools provide options for video conferencing, messaging, and file storage that make classrooms organised and easy to work in. In addition, they typically permit the exchange of a variety of file formats, such as Word, PDF, Excel, audio, and video files. The offered platform also allows for the monitoring and evaluation of students' learning progress through the use of online tests and rubric-based assessments.

As COVID-19 spread throughout the remainder of the country, including Malaysia, the majority of schools and industries progressively resumed normal operations. In relation to this, research was conducted to determine the level of digital literacy among STEM teachers have in both condition tangible and intangible. According to Murgatroyd and Sahlberg (2016), the challenges of e-learning consist of accessibility, cost, adaptability, learning methodology, lifelong learning, and educational policy. The COVID-19 pandemic has created opportunities for the distant goal of establishing an e-learning system, despite the fact that educators, institutions, and the government have encountered formidable obstacles in regard to online education. On the other hand, COVID-19 has established a strong connection between STEM teachers and digital platforms that can be utilised to supplement teacher learning and instruction in the delivery of essential subjects such as STEM. It is essential to investigate how STEM teachers in Malaysia adapted to using digital resources after the COVID-19 outbreak. Therefore, the aim of this study is to identify STEM teachers’ digital literacy in teaching and learning STEM subjects post-COVID-19.

Contrary to this positive development post-pandemic, there has been little discussion about the study of STEM teachers' digital literacy competencies and challenges post-Covid-19 to sustain the use and implementation of digital technology resources in teaching and learning in essential subjects like science, biology, chemistry, physics, and mathematics. The willingness of instructors to adopt new teaching methods is one of the most important determinants of educational progress (Hata & Mahmud, 2020). Involvement, confidence, curiosity, and comprehension of integrated STEM disciplines will increase as a result of
indirect STEM integration teaching experiences. In addition, STEM integration activities in the classroom can assist students in developing positive attitudes and beliefs regarding their ability to excel in STEM fields (Mahmud et al., 2018). Thus, it is necessary to conduct research on STEM teachers’ competencies in digital literacy. Therefore, this study addresses the following main objectives:

3. To investigate the influence of STEM teacher digital literacy knowledge towards technology integration in teaching and learning post Covid-19.

2.0 LITERATURE REVIEW

2.1 STEM Teacher Digital Literacy

Through the lens of praxeology, digital literacy is viewed in the context of digital security (Kern et al., 2018). This is considering that schoolteachers engage in activities that aim to reduce problematic online behaviour, such as cyberbullying (Pyżalski, 2012; Kopeck & Szotkowski, 2017); unsafe use of the internet (Fineberg et al., 2018); recognising the mechanisms of online abuse (Walotek-Ściańska et al., 2014); and image protection. Subsequently, the constant transition from digital to predominantly digital has been extensively utilised, particularly during COVID-19, which has improved teacher digital literacy. Regardless, digital literacy has emerged as one of the required skills and competencies of the twenty-first century. Considering the complexity of the educational issues teachers and parents confront today compared to those of the analogue era, this remark gains even more impact (Bayraktar, Van Roosbroeck, & Calin, 2017). In addition to preventing the creation of potentially risky circumstances offline, parents and educators must also be aware of emergent digital and hybrid risks (Tomczyk, 2019).

Several competencies that are typically associated with digital literacy must be discovered. The majority of the competencies and attitudes associated with these particular skills are centred on operational and integrating processes. Moreover, there is always the functionality of the features within the integrated technical and operational skills of STEM teachers in order to prevent the tool from becoming technologically obsolete. In addition, digital literacy was added as a distinct skill to cultivate alongside mathematics, science, linguistics, social skills, and the arts. According to recent research, it is essential for teachers,
particularly STEM teachers, to use ICT in a persuasive manner that could aid the STEM teacher in guiding enjoyable and engaging learning in the classroom. Every STEM educator should be able to improve their digital utilisation skills and utilise TACs (technology for learning and knowledge), which aid in the gradual development of their digital literacy. As was previously stated, STEM teachers’ attitudes towards the Internet, computers, tablets, and smartphones, as well as their knowledge of how to utilise digital resources in teaching and learning, all influence and are correlated with their knowledge of digital media. A negative attitude makes it more difficult to comprehend how ICT is utilised, both positively and negatively, and how it influences learning environments and the conduct of children and adolescents (Hobbs & Tuzel, 2017).

Preradović et al. (2017) and Eger et al. (2018) found that teachers and future teachers have different views on the use of new media in education, and that their ICT-related perspectives and skills in using hardware, software, and e-services change over time. Regardless of country of origin or level of education, we need to be mindful of the variation in STEM teachers' knowledge, abilities, and attitudes while analysing digital literacy among STEM teachers. The COVID-19 epidemic is now another factor influencing how digital technology is used in various aspects of daily life, including the social, economic, political, and even personal aspects. It is a mistake to consider that the industry of 4.0 will motivate and grow its presence in the digital world, as each individual is said to have different digital literacy and skills. In this context, McGinty (2020) makes the case that if we can motivate experience teacher to mentor one another, they may experience more peer-based social support, which would increase the diffusion of digital literacy.

The COVID-19 pandemic has increased the need for programmers to design technology that is accessible to users of any generation. This will allow users to utilise technology in their daily lives more effectively. This innovation could enable people of all ages and backgrounds to utilise digital technology and become acquainted with various digital resources. Digital literacy can also lead to contentious digital processes that must be addressed to achieve the highest level of social inclusion, which always includes critical literacy. In conclusion, digital literacy could result in an array of literacy requirements that are advantageous for all.

2.2 STEM Teacher Knowledge
Currently, teacher knowledge are viewed as "context-specific, cognitive performance dispositions that are functionally sensitive to situations and demands in certain domains". According to Blömeke (2017), numerous studies have been conducted on general models of
professional competence, including both cognitive and affective motivation domains. On the basis of Shulman's (1987) taxonomy of teacher knowledge, researchers distinguish between teachers' content knowledge (CK), pedagogical content knowledge (PCK), and generic pedagogical knowledge (GPK).

In response to the growing significance of the ICT transformation in educational systems, teachers' competencies have been expanded to include the knowledge expected to dominate the challenges associated with using ICT in teaching and learning at school (Selwyn, 2012). By defining teachers' technological knowledge (TK), content knowledge (CK), pedagogical content knowledge (PCK), and general content knowledge (GPK), respectively, Mishra and Koehler (2006) developed the well-known approach. As depicted in Figure 3, the TPACK model is frequently illustrated using a Venn diagram.

![Source: Mishra & Koehler (2006)](image)

Figure 1: TPACK model

TPACK is a set of frameworks that can be used to interpret a teacher's experience of acquiring knowledge in the areas of technology, pedagogy, and content. The interconnectedness of the circle emphasises that, unlike in the past, when technology was considered distinct from content and pedagogy, they are now viewed as interdependent and significant. This framework allows instructors to self-evaluate their ICT technology application, classroom practise, and subject matter comprehension in general. All teachers of the subject should be able to employ technology to pedagogical concepts and teaching practise in their instruction and learning.

After COVID-19, STEM teachers must not only possess the required skills, but also be able to implement and adapt their comprehension of digital technologies to their teaching and learning. Ultimately, the STEM Teacher's digital literacy competencies could influence their motivation to continue using and implementing various digital resource platforms once normal teaching and learning resumes following the COVID-19 pandemic. Regarding the affective-motivational domain, highlight teachers' self-efficacy as one of the most important teacher
competence constructs (Lauermann & Konig, 2016). Bandura's (1997) research defines teachers' self-efficacy as their conviction in their ability to succeed under specific circumstances. Consequently, we can assert that teachers' self-efficacy as the primary resource in teaching and learning obligates them to modify their knowledge of digital resources in the continuation of integrating technology in STEM teacher teaching and learning after the COVID-19 pandemic. This acquisition of competencies for a sustainable digital society—digitainability—implies new pedagogical dynamics and methodologies that support blended learning, the flipped classroom, inquiry-participatory learning, and smart teaching learning, both in the face-to-face context of the learning and teaching process and in the distance learning mode (Santos et al., 2020). These numerous methods of learning have their own merits, and they foster the dynamics and differences of learning, which could improve students' self-learning after the release of COVID-19.

The processes of digital learning occur in a variety of contexts, such as the social, economic, and even cultural changes caused by COVID-19. Foreword (2020) claims that the COVID-19 pandemic has resulted in learning loss, an increase in online learning at all levels of education, and a means of continuing to provide training regarding the changes that COVID-19 has brought about in education and, specifically, in the learning and teaching process. Therefore, now is the opportune time for STEM teachers to learn the best practises and generate evidence that will enhance their teaching and learning. The disruptive revolution caused by COVID-19 has resulted in an immediate paradigm shift in how individuals, societies, and governments perceive and respond to this rapidly evolving work. According to the "new normality," which is characterised by the extremely high use of digital technologies, "citizens of all ages employ digital literacy practises to study, remain informed, and care for and connect with family, friends, and communities near and far" (Buchholz, DeHart, & Moorman, 2020, p. 12).

2.3 Challenge in Integrating Digital Technology

We cannot perceive digital technology as "neutral objects," despite its emergence as an essential teaching and learning tool for educators during the COVID-19 pandemic. Age, gender, and culture influence the quantity and quality of information STEM teachers have access to, as well as their capacity and ability to develop content. In some instances, disparities can result in unequal social reproduction (Nascimento, 2015). Moreover, Nascimento (2015) argues that despite the democratic participation and freedom of expression underlying digital social networks and information access, these developments pose a risk of "reproducing or
even exacerbating forms of discrimination and attempts to silence socially discriminated
groups."

Van Dijk and Hacker (2003) assert that the following factors contribute to a lack of
basic digital experience:

- A lack of interest in or worry about using the technologies, or technology design
  features that deter use.
- Not having access to the technologies, such as not having a digital device or an
  internet connection.
- A lack of digital abilities resulting from infrequent use of or unfamiliarity with new
  technology.
- Limited opportunities for major usage as a result of time constraints and access
  competition at home or at work.

In addition, the challenges of ensuring continuity in integrating technology into teaching
practise are exacerbated by the effectiveness of digital resource utilisation. As previously
stated, for the full implementation of Society 5.0, many of these technologies do not yet exist
in an effective and efficient form, posing a number of challenges (Alvarez-Cedillo et al., 2019).
Deguchi et al. (2020) also noted that one of the challenges society faces in achieving
 technological competence is "when the raw real-world data must be analysed by Society 5.0's
computer systems using a structure that is identical to the actual, physical world" (p. 3). The
ultimate goal of Society 5.0 is to bring real-world models into cyberspace so that they can
provide highly nuanced solutions to problems that arise in the real world. According to
Alvarez-Cedillo et al. (2019), the implementation of digital literacy requires three main
changes among individuals: technological change, economic and geopolitical change, and a
change of mindset. The implementation of technologies is dependent not only on a decent and
functional infrastructure, but also on the needs and abilities of society and government policy.
Numerous factors must be considered in order to cultivate an individual with proficient
technological knowledge. In order to shape the digital literacy of STEM teachers, it is essential
to encourage participation and social equity (Tran et al., 2020).

Spires (2019) states, above all, human agency is at the heart of what it means to be
digitally literate. In the modern world, everyone is expected to know at least the basics of digital
technologies, which have become one of the most important tools we use every day. But it's
not as easy for STEM teachers to keep using and implementing digital tools in teaching and
learning as it was during the COVID-19 pandemic, when the main way for STEM teachers and students to communicate to each other was online. Yousefikhah (2017) notes rightly that infrastructure is not the only thing that needs to be in place for growth to happen. Many of these professionals were unaware of how to use remote learning tools, which made their already hard lives even harder and led to more problems with equity and access (Buchholz et al., 2020).

### 3.0 METHODOLOGY

#### 3.1 Research Design

This study involved quantitative research design using a survey method that was distributed to the STEM teachers in the National Secondary School in a state on the east coast of peninsular Malaysia.

#### 3.2 Respondents

Respondents to this study were 150 teachers in STEM subjects who were between the ages of 25 and 50. The approach for selecting samples utilises multiple stages of random sampling at various points along the process. During the initial stage of the process, various provinces in Kuala Terengganu, Malaysia, were chosen randomly. After that, in the second stage, schools from all of the different districts and cities in the selected provinces were picked at random. In the end, a total of 150 STEM teachers from 15 different schools in the state of Kuala Terengganu were considered respondents in this study.

#### 3.3 Instrument

The survey instrument in this study used a questionnaire with three sections: (i) Demographic information, (ii) STEM Teacher’s knowledge in digital literacy and (iii) STEM teacher’s technology integration.

##### 3.3.1 Demographic information

This section contains demographic data on research participants, which is important for determining whether a group's members are a representative sample of the target population for generalisation purposes. As independent variables in the research design, demographic or research participant characteristics are typically reported in the methods portion of the research report. Because they cannot be changed, the demographic variables are, by definition, independent variables. The study sample is described by its demographics, and the moderating influence of demographic characteristics on dependent variables can also be investigated.
3.3.2 STEM Teacher's knowledge in digital literacy

The instruments used to identify STEM Teacher’s knowledge in this explanatory study were modified and taken from previous study that dealt with teacher digital literacy. ACDC (Analysis of Common Digital Competencies) questionnaires was employed from Santiago et al. (2021). This instrument was adapted and proposed to be an appropriate tool in gathering a data related to Teacher’s knowledge in digital literacy. All of the items in this questionnaire were closed-ended and 4-point Likert scale: “1"Very Low Level," 2 "Low Level," 3 "High Level," and 4 denoting "Very High Level."

3.3.3 STEM teacher’s technology integration

Similar to the instrument used for STEM teachers’ knowledge in digital literacy. The teacher’s technology integration was adapted from the questionnaire in Santiago et al.'s (2021) research. This instrument also has a 4-point Likert scale.

3.4 Data Collection Procedures

There are several stages involved in the collection of data in this study. The procedure began with a discussion of the study's topic, research topic selection, research objectives, and research questions, which were then sent to the supervisor for verification. The second phase consisted of choosing the materials, examining the materials, and conferring with the supervisors. To increase the reliability and validity of the instruments, the process of developing research item validation persisted. The distribution of the instruments to the respondents was done physically with permission from the school principal. After the data collection was completed, researchers began to analyse the data using appropriate software and statistical analysis.

3.5 Data Analysis

Statistical Package for the Social Sciences (SPSS) version 23.0 was utilised for the descriptive, correlational, and regression analyses in this study. To determine the level of STEM teachers' digital literacy knowledge and technology integration, descriptive analysis was utilised. The normality of the data distribution is evaluated in order to select the type of correlation test. Then, using linear regression analysis, the influence of STEM teachers' digital literacy knowledge on the integration of technology in their teaching and learning was analysed.
4.0 FINDINGS AND DISCUSSION

4.1 Demographic Background

Table 1 shows the number and percentage of responses from 150 STEM teachers in the district of Kuala Terengganu. Of these teachers, 57 (38%) were men and 93 (62%) were women. Based on their academic backgrounds, only one teacher (0.7%) has a high school education, 126 (84%) have a bachelor's degree, and others have a master's degree (15.3%). Table 1 shows the respondents profiles with their range of ages, years of teaching, and teaching options.

Table 1: Demographic analysis of respondents

<table>
<thead>
<tr>
<th>Respondents’ background</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>57</td>
<td>38</td>
</tr>
<tr>
<td>Female</td>
<td>93</td>
<td>62</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>• Academic background</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diploma</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Degree</td>
<td>126</td>
<td>84</td>
</tr>
<tr>
<td>Master</td>
<td>23</td>
<td>15.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>• Aged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-30</td>
<td>8</td>
<td>5.3</td>
</tr>
<tr>
<td>31-35</td>
<td>7</td>
<td>24.7</td>
</tr>
<tr>
<td>36-40</td>
<td>48</td>
<td>32</td>
</tr>
<tr>
<td>Above 41</td>
<td>57</td>
<td>38</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>• Year of teaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 5 years</td>
<td>24</td>
<td>16.0</td>
</tr>
<tr>
<td>5-10 years</td>
<td>33</td>
<td>22.0</td>
</tr>
<tr>
<td>11-15 years</td>
<td>52</td>
<td>34.7</td>
</tr>
<tr>
<td>More than 15 years</td>
<td>41</td>
<td>27.3</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>• Options</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science</td>
<td>66</td>
<td>44</td>
</tr>
<tr>
<td>Mathematics</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>Physics</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Chemistry</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Biology</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>150</td>
<td>100</td>
</tr>
</tbody>
</table>
4.2 Level of Knowledge in Digital Literacy and Technology Integration in Teaching and Learning Post COVID-19

Descriptive analysis was used to explain the results in the form of mean scores and standard deviations to respond to this research question. The mean score was interpreted based on Nunnally and Bernstein (1994) interpretation (see Table 2).

<table>
<thead>
<tr>
<th>Mean score</th>
<th>Mean interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00 – 2.00</td>
<td>Low</td>
</tr>
<tr>
<td>2.01 – 3.00</td>
<td>Middle low</td>
</tr>
<tr>
<td>3.01 – 4.00</td>
<td>Middle high</td>
</tr>
<tr>
<td>4.01 – 5.00</td>
<td>High</td>
</tr>
</tbody>
</table>

*Source: Nunnally and Bernstein (1994)*

Table 3 displays the STEM Teacher level of digital literacy and technology integration in teaching and learning post-Covid-19. Based on the findings, the level of digital literacy and technology integration in teaching and learning post-COVID-19 was equally high. Rapanta et al. (2020) claimed that the more knowledgeable and competent teachers are in teaching, the better their digital literacy growth. Results from Cucu et al. (2022) also revealed that teacher digital literacy has a significant impact on raising the level of instruction. Therefore, in order to improve the quality of their teaching and learning, teachers must possess digital literacy knowledge and competencies.

<table>
<thead>
<tr>
<th>No</th>
<th>Sub-dimension</th>
<th>Mean value</th>
<th>Standard deviation</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge in digital tools</td>
<td>3.91</td>
<td>0.48</td>
<td>Middle high</td>
</tr>
<tr>
<td>2</td>
<td>Communications and Collaborations</td>
<td>3.87</td>
<td>0.45</td>
<td>Middle high</td>
</tr>
<tr>
<td>3</td>
<td>Digital content creation</td>
<td>3.66</td>
<td>0.55</td>
<td>Middle high</td>
</tr>
<tr>
<td>4</td>
<td>Security</td>
<td>3.82</td>
<td>0.83</td>
<td>Middle high</td>
</tr>
<tr>
<td>5</td>
<td>Problem resolution</td>
<td>3.93</td>
<td>0.49</td>
<td>Middle high</td>
</tr>
<tr>
<td>6</td>
<td>Technology Integration</td>
<td>3.58</td>
<td>0.57</td>
<td>Middle high</td>
</tr>
</tbody>
</table>

*Overall* 3.80 0.56 Middle high
Based on the results, we can say that most STEM teachers were familiar with technology, but the level of integration is not yet outstanding. Contradicted from past studies, Ismail & Jarrah, (2019), say that teachers are very well prepared to use ICT in their teaching and learning. However, researchers need to find out why it is challenging for teachers to use technology in STEM subjects after COVID-19.

4.3 Relationship between Digital Literacy and Technology Integration in Teaching and Learning Post COVID-19

To answer the second research question, correlation analysis was conducted to identify the relationship between STEM teacher knowledge in digital literacy and technology integration in teaching and learning post COVID-19. The normality test, which is shown in Table 4, was used as a matrix test to check the normality of the data distribution before correlation analysis was carried out throughout the study. Since the number of respondents n is greater than 50 (n = 150), Kolmogorov-Smirnov tests of normality are used. The results of the normality test revealed that p> 0.05, which indicates that the data distribution is normal. Therefore, a Pearson correlation test was carried out in this study.

Table 4: Normality test

<table>
<thead>
<tr>
<th>F value</th>
<th>df1</th>
<th>Significant level (p)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.066</td>
<td>150</td>
<td>0.2</td>
</tr>
</tbody>
</table>

If the significant number was less than 0.05, the two factors are said to be related. But if the significant number was greater than 0.05, it means that the two factors do not have any correlation. Based on the results shown in Table 5, there is a significant and highly correlated (r = 0.70) relationship between STEM teacher knowledge in digital literacy and technology integration in teaching and learning post-Covid-19.
Table 5: Correlations between STEM teacher knowledge in digital literacy and technology integration in teaching and learning post Covid-19

<table>
<thead>
<tr>
<th>Variables</th>
<th>Knowledge in Digital Literacy</th>
<th>Technology Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge in Digital Literacy Pearson Correlation</td>
<td>1</td>
<td>0.70</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>0.00**</td>
</tr>
<tr>
<td>N</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Technology Integration</td>
<td>Pearson Correlation</td>
<td>0.70</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td>0.00**</td>
</tr>
<tr>
<td>N</td>
<td>150</td>
<td>150</td>
</tr>
</tbody>
</table>

**Correlation is significant at the 0.01 level (2-tailed).**

Based on this result, we could conclude that the two variables have a strong relationship. Overall, the findings of the study regarding the relationship between teacher knowledge of digital literacy and technology integration in teaching and learning showed a positive correlation. The findings revealed that STEM teachers with a high level of digital literacy knowledge are able to implement technology-based teaching and learning. This study's results are consistent with Cucu et al. (2022). The study's findings indicate that teacher digital literacy has a substantial effect on enhancing educational standards. Teachers must be digitally literate in order to improve the quality of their teaching and learning.

4.4 Influence of Knowledge in Digital Literacy and Technology Integration in Teaching and Learning Post COVID-19

Linear regression was used to figure out the influence of STEM teacher knowledge in digital literacy (X) and technology integration in teaching and learning post-COVID-19 (Y). Based on the data in Table 6, the beta value that has been obtained is 0.89, which explains how STEM teacher knowledge in digital literacy will affect the increasing of 0.078 per 1 unit value in technology integration.
Table 6: Influence of knowledge in digital literacy and technology integration in teaching and learning post Covid-19

<table>
<thead>
<tr>
<th>Variable</th>
<th>Technology Integration</th>
<th>t</th>
<th>p</th>
<th>Contributions (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.17</td>
<td>0.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge in Digital Literacy</td>
<td>0.89</td>
<td>0.69</td>
<td>11.46</td>
<td>0.00</td>
</tr>
</tbody>
</table>

\[ F=131.312 \quad R=0.69 \]
\[ \text{Sig } F=p<0.05 \quad R \text{ squared}=0.47 \]

Based on this analysis, the regression equation can be constructed per below:

\[ Y=0.17 + 0.89 \times (X) \]

Y= Technology Integration in teaching and learning
X= STEM Teacher Knowledge in Digital Literacy

The fact that there is a significant correlation as well as a positive influence value between STEM Teacher knowledge in digital literacy and technology integration demonstrates that teachers who have good knowledge in digital literacy are thereby able to make a contribution to implementing technology in their teaching and learning. According to Durriyah and Zuhdi (2018), educators who regularly use digital technology no longer feel anxious when it comes to integrating technology into their teaching and learning. According to Brothwich (2017), it was discovered that teachers who are able to use technology are able to manage the classroom in a way that promotes active and productive learning, and these teachers are also exposed to the process of problem solving.

We want teachers to be more proactive and better able to run their classrooms in the era of 4.0IR. When all students in the classroom take part in active learning, it can spark a lot of interest among students to keep taking part and learning in the classroom. Aside from that, school is one of the most important things that can make these goals a reality. Schools need to have good facilities to ensure that teachers can use technology to engage students in learning. Wenshuang et al. (2018) said that there is an urgent need for a training programme that assists teachers in reaching optimal levels of digital competency so that a true paradigm shift can happen, which will eventually combine effective methods and educational strategies that involve the integration of technology in teaching and learning.
5.0 CONCLUSION

In conclusion, STEM teacher digital literacy can impact their technology integration in teaching and learning. In addition, this study revealed a positive correlation between STEM teachers' digital literacy and their use of technology in the classroom. Consequently, this study demonstrates that STEM teacher digital literacy contributes 47% to technology integration in teaching and learning. Teachers' digital literacy could be bolstered through the implementation of an appropriate curriculum and instruction. Due to the fact that the study was limited to the Kuala Terengganu district, the researcher was unable to obtain a complete image of STEM teacher digital literacy in Malaysia. This study only focuses on the Kuala Terengganu region, where the majority of STEM teachers lack adequate technology training. For future research, the study can expand to other districts in Malaysia and propose appropriate guidelines and instructional materials on how to assist senior teachers in familiarising themselves with the integration of technology into their teaching and learning. Since the layout of most schools is not conducive to technology integration in the classroom, schools require substantial funding to renovate all facilities in order to make this possibility a reality. This endeavour necessitates a great deal of contributions and cooperation, not only from the school's organization but also from members of the surrounding community.

REFERENCES


