Factors and Barriers Influencing Technology Integration in the Classroom

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ABSTRACT

This study aimed to determine the factors and barriers influencing technology integration inside the classroom and how teachers integrate technology in their teachings. The study employed a systematic review of the literature of previous research. The researchers utilized online databases from Ebscohost and ERIC. Through inclusion-exclusion criteria and a PRISMA Flowchart guide, 46 articles (qualitative – 19; quantitative – 27) were generated and considered eligible and used in the research. By utilizing a research article grid, similarities and differences were identified and analyzed. Personal factors (i.e., teachers' and students' perspectives and attitudes) and professional factors (i.e., tenure, training, workshops) were the main factors affecting technology integration. Barriers such as not enough computers, low internet access, malfunction of printers and computers, computer virus attacks, and others were also revealed. On the other hand, suggestions, and recommendations in integrating technology in the classroom were given, like optimizing digital technology's pedagogies, implementing directives to develop "net" skills, modifying school curriculums, and
1. INTRODUCTION
Education remains unchanged, even though the societies have changed from industrial to information, and knowledge has become essential. The United Nations Sustainable Development Goal Four (SDG 4) (UNESCO, 2020) states to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" for the desire of improvement. On the other path, Bilwani and Zehra (2016) stated that industrialism, commercialism, and even technology had permeated geographic and political barriers, but education was left behind. In this case, lots of efforts have been made to lessen the problems in the educational system.

Generally, technology integration is defined as using technology resources like computers, mobiles, cameras, networks and social media platforms, software applications, and internets used in classroom activities and school management (George Lucas Educational Foundation, 2007). In connection, technology plays a significant role in student learning since more K to 12 institutions recognize technology integration as an initiative to prepare students to be globally engaged, making learners more responsible and active (Hanimoğlu, 2018; Wieking, 2016). The effective use of technology could genuinely develop essential 21st-century skills and enhance learning to prepare students to be globally competitive (Louis, 2012). Hanimoğlu (2018) emphasized that teachers become learners and improve their teaching performance, resulting in more content with the learners. Also, since the digital environment has changed how the students learn today, even teachers' approaches and strategies must adapt to the technology-rich environment (Banitt et al., 2013).

With the demand in education to solve the different burdens being faced, school officials and administrators tried many solutions to promote students' engagement, including implementing technology into curricula (Harris et al., 2016). However, since technology integration is complicated and challenging, the process of solving becomes limited (Wilson-Strydom et al., 2005). So, to solve this initially, there must be an interaction from the different stakeholders to identify objectives and strategies to be used in integration technology in both school and classroom settings (Yeh et al., 2011). As stressed, the presence of teachers is essential in such deliberation in the enhancement of the curriculum. In support, Singhavi and Basargekar (2019) agreed that they must be part of the planning until implementation because they can tell more experiences with students through their teachings. As also seen, having sufficient tools (Kuyatt et al., 2015; Noori, 2019; Sibanyoni & Alexander, 2017; Singhavi & Basargeker, 2019) and having enough training and knowledge on technology use (El Fadil, 2015; Hanimoğlu, 2018; Harris, 2016; Islahi & Nasrin, 2019; Kennedy & Ferdig, 2018; Noori, 2019; Özdemir, 2017; Somera, 2018) can become significant factors that will improve the quality of technology integration. However, the teachers' lack of confidence and competence significantly affects such a desire to change. Besides, several studies say that teachers indeed encounter
different challenges despite the promising benefits of technology. In the study of Hanimoğlu (2018), teachers were only exposed to using essential tools like MS Word, Excel, and PowerPoint, and less exposed to graphic software like Photoshop, Paint, Corel Draw, and others. The challenges encountered may be due to the teachers' not knowing how to use the technology or finding it complicated. Teachers' lack of technology experience leads to lower-level thinking processes (Louis, 2012) and low computer literacy. If this continues, teachers may not be willing to implement technology in the classroom, which becomes a significant hurdle in technology implementation (Singhavi & Basargekar, 2019). They know how to use these tools, but not creatively and effectively.

After all, teachers are seen and anticipated to change the Information Age, where knowledge can be reached anytime. They expect that integrating technology will help innovate the education's paradigm (Hero, 2019), though such steps to enhance the teaching with new technology are seen as complicated. Some things need to be identified, like the barriers or problems that are needed to be solved. On the other hand, perceptions, actions, and attitudes towards new technology depend on learning and teaching productivity and improvement. As implied, the technology acceptance postulates teachers to be inclined to use new technology and perceive it as helpful and easy to use. Such existing and emerging factors are crucial, and the actions being done might result in the failure or success of the whole education (Alberth, 2010; Erkan, 2019; FitzPatrick, 2012; Teo, 2012; Volery & Lord, 2000).

Hence, the present study aims to surface the different factors and barriers affecting technology integration and how teachers integrate technology in their teaching. Specifically, the following questions were addressed:

1. What are the factors that influence technology integration?
2. What are the barriers that affect technology integration?
3. How do teachers deal with the new technology in the classroom?

2. METHODS

2.1 Research Design

The present study utilized a systematic literature review (SLR) which aimed to evaluate previous studies and to identify the different factors and barriers of technology integration in both teaching and learning inside the classroom. Moher et al. (2015) said this design collects all relevant evidence and screening using criteria. Like previous studies doing SLR, the researchers also used the guidelines of Okoli (2015), which Hanimoğlu (2018) said involves critically appraising and synthesizing research to give a comprehensive and thorough summary of evidence significant to the research questions.

2.2 Data Gathering Tools

Two databases were used in the present study, namely: Ebscohost and ERIC. First, Ebscohost has been accessed in the university where the researchers are affiliated. Aside from that, this database is proven accurate, reliable, and up to date in accessing journal articles and other publications on a particular topic within the subject areas covered by each database (National Association of Realtors, 2016; University College London, 2021).
On the other hand, the Educational Resources Information Center (ERIC) database was also used since it is the most widely used index in educational-related literature (Dagenais Brown, 2003; LibGuides, 2021).

The phrase “factors that influence technology integration in the classroom” was searched in finding multiple articles. However, these articles were explicitly and extensively filtered by examining most of their parts using inclusion-exclusion criteria (Table 1). The journal publication type, language used, year of publication, and demographic location were considered. In addition, the search was steered using the PRISMA flowchart developed by Moher et al. (2009) (see Diagram 1).

Table 1. Inclusion-Exclusion Criteria used by the Present Study

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<tr>
<th>Criteria</th>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
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<tr>
<td>Journal Publication Type</td>
<td>Journal articles published in Ebscohost, Education Resources Information Center (ERIC), and other considered credible databases</td>
<td>Reports (research, evaluative, descriptive), opinion papers, questionnaires/test, information analyses that are published or not in Ebscohost, Education Resources Information Center (ERIC), and other considered credible databases</td>
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<td></td>
<td>Journal articles must be in full text and undergo peer-reviewing</td>
<td>Journals that were not in full text and did not undergo peer-reviewing</td>
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<tr>
<td>Language</td>
<td>Journals using English as a medium, including those that are transcribed in English</td>
<td>Journals not using English as a medium</td>
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<td>Year of Publication</td>
<td>Journals Published within 2010-2020</td>
<td>Journals published before 2010</td>
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<tr>
<td>Demographic Location</td>
<td>Journal setting is in Asia</td>
<td>Journal setting is outside Asia</td>
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The researchers also made and used a grid to organize and appraise the data from the eligible articles. This grid is used to find similarities and differences among the different research articles to derive possible themes for the present research.
2.3 Data Gathering Procedures
At the outset, the search generated 44,984 articles from the two selected electronic databases - Ebscohost (N=33,090) ERIC (N=11,894). Besides, 60 articles were added through other online databases. Despite 45,044 journal articles, 44,989 were screened after removing 55 duplicated articles.

Further selection was made when the researchers considered full-text and peer-reviewed journals. Many articles (N=41,198) were excluded, with 3,791 remaining pieces. In addition, the selection continued, and the researchers specified the time frame from 2010 to 2020. As explained, what to review needs to be recent, and according to Wolf (2019), the golden rule of thumb of selecting or choosing published articles must be within the past (10) years, especially if it is in humanities, arts, literature, history, and other related areas. The past two to three years need to be considered for faster-paced fields because these sources are more up-to-date and reflect the newest best practices, discoveries, processes, and theories. Hence, 1,312 were selected, removing 2,479 journal articles.

Next, the language was considered, and only those remaining articles were written in English. With this, 12 journal articles were excluded because those were written in other foreign languages, having a remaining total of 1,300 journal articles written in the target language. Lastly, the demographic location was considered for screening the journal articles further, and it was selected to focus on Asia. With that, 1,254 were removed, and only 46 journal articles were conducted in Asia. For the synthesis, 19 qualitative and 27 quantitative studies were included. In summary, the PRISMA flow chart below (see Diagram 1) showed the selection and evaluation of the articles.

<table>
<thead>
<tr>
<th>Research Article/Reference</th>
<th>Country</th>
<th>Technology Integration Practices</th>
<th>Factors</th>
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<td>Personal (i.e. Motivation, attitude, perception, age)</td>
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Moreover, the researchers made a note-taking method using a self-made grid, as shown in Table 2, to synthesize and appraise the eligible articles. Specifically, this aimed to compare the different studies by looking at their similarities and differences in the various factors affecting the technology integration in the classroom and even the teaching practices used in the said integration.

2.4 Data Analysis
Thematic analysis was used in analyzing the data. In detail, the researchers focused on answering the research questions; thus, having three significant themes, namely: (1) factors influencing technology integration with sub-themes (1. a) personal problems and (1. b) professional factors, (2) barriers affecting technology integration with sub-themes (2. a) technology-sourced problems and (2. b) professional development-related problems, and (3) ways on how teachers integrate technology inside the classroom with sub-themes (3. a) curriculum integration of ICT and (3. b) utilizing digital literacy skills.
4. FINDINGS AND DISCUSSION

4.1. Factors Influencing Technology Integration

Personal Factors Affecting Technology Integration

One of the essential elements in implementing curriculum success is the personal factors of teaching. As teachers apply technology in their teaching method, these personal factors also affect how successful the implementation will be. Alberth (2010), Erkan (2019), FitzPatrick (2012), Islahi & Nasrin, 2019, Özdemir (2017), Singhavi and Basargekar (2019), Teo (2012), and Volery & Lord, 2000) together emphasized that the professed usefulness, how to use, and facilitating condition of teachers can influence behavioral intention to use technology. For example, teachers see technology as necessary in increasing their productivity, their purpose of using technology increases also. Moreover, the way teachers present themselves and their abilities can significantly affect how they are involved in digital technology. Their perceived ease of use was significantly associated with using technology as a tool in both learning and teaching to monitor their technology integration practice (Nueva, 2019).

Notably, the experiences, including the perceptions and attitudes of teachers towards ICT integration, constitute a significant factor. Typically, teachers who know technology or the integration of ICT in their teachings must be the ones who are active in promoting and helping beginner teachers. However, the study of Dela Rosa (2016) showed that teachers (specifically in the language area) who are novices become more resourceful and innovative, while those who are experienced become less motivated and use traditional resources. In this context, the term "experienced" does not mean that these teachers are technology experts, but it pertains to their years of teaching experience. Regardless of the years, if they were not overexposed to technology integration and less or no one helped them, they will undoubtedly have a negative attitude and continue teaching using the traditional means. If new tools are introduced, they will not last for long to learn, and they might experience pressure or fear of learning. So, there are things that need to be done, and initially, changing the attitudes and perceptions of teachers in positive ways by introducing training and workshops.

Professional Factors Affecting Technology Integration

There are reasons why teachers are confident in using technology in the classroom. These may be because they have gained training, seminars, resources, and materials that influence teachers' capability. According to Singhavi and Basargekar (2019), teachers' training programs significantly develop the computer skills, capabilities, and attitudes necessary for implementing ICT. Besides, if this training continues, like giving endless opportunities to acquire new knowledge, they can stay on the "top of the game." As proven, even if the teachers are experienced in ICT, they will be left behind if they do not continue to learn and update what they know.

Özdemir (2017) conducted a study in Turkey. The study found out that the teachers have high information technology competency in "Basic Computer Operation Skills, Setup, Maintenance, and Troubleshooting of Equipment, Word Processing, Networking, Media Communication"; and medium in "Spreadsheets, Database,
Telecommunication, and Social, Legal and Ethical Issues." Therefore, having enough knowledge in these areas will make teachers feel confident in teaching. However, if these can be considered one of the bases of evaluating teachers' competencies in technology, then it implies that teachers who have just basic knowledge have many things to catch up on.

Therefore, it is vital to develop training programs implemented by institutions, follow guidelines, and introduce materials based on teachers' experiences and expertise (Mardiana, 2020). These training, seminars, and support allow more teachers to be fully equipped with technological skills that they can use in the classroom as part of technology integration. As teachers become more involved in changing technology, it also translates into a more substantial possibility of successful technology integration. Thus, teachers with enough training and support in building relevant technology skills in school become quality teachers.

However, just implementing training is not enough to help teachers. They must be supported in integrating digital technology. Also, they need full scaffoldings to learn and maximize the software's features. Singhavi and Basargekar (2019) explained that insufficient technical support for teachers could lead to difficulty in preparing and applying technology. In addition, the success of the implementation will perceive its value and use it in their teaching.

Though it must be pointed out that not all teachers are the same because commanding technology may not be helpful in some perspective, they may experience pressure, which will worsen instead of solving such problems. Therefore, orientation and even needs assessment on technology integration may fully understand how teachers utilize technology.

4.2. Barriers Affecting Technology Integration

While technology integration has promising positive outcomes, it is inevitable that barriers also exist. As reflected in the different studies, it was found out that there were two (2) main problems or barriers experienced by schools in the integration of technology inside the classroom. These are (1) Technology-Sourced Problems which include inadequate technological resources such as computers, internet connection, technology instruction, and others (Dela Rosa, 2016; Erkan, 2019; Ghavifekr & Rosdy, 2015; Noori, 2019; Schindler et al., 2017; Singhavi & Basargekar, 2019). On the other hand, focused on the (2) Professional Development-Related Problems which covers the lack of training, policies, programs, but not limited as well to the attitudes and perceptions towards technology integration (Arinto, 2016; Ghavifekr & Rosdy, 2015; Hanımoğlu, 2018; Mardiana, 2020; Noori, 2019; Singhavi & Basargekar, 2019; Wong & Looi, 2014, Yeung et al., 2012).

Technology-Sourced Problems

Most schools in Asia experience hardships in technology, which becomes the main problem and incredibly stressful for teachers and students in the learning process (Ghavifekr & Rosdy, 2015). As emphasized, technology-sourced problems exist even among teachers and students' barriers, and these are indeed unavoidable (Erkan, 2019;
Schindler et al., 2017).

One of the main problems seen is insufficient computers, printers, and other devices used in teaching and learning (Dela Rosa, 2016; Ghavifekr & Rosdy, 2015; Noori, 2009). For instance, in Afghanistan, Noori (2019) stated that despite the high positive attitudes of English teachers towards instructional technologies, it hindered them from working efficiently. The study conducted was quantitative, and more studies need to be undertaken to support it. However, one thing is sure that teachers who have more access to computers (and the internet) will be more effective in their teachings.

Considering that they have the resources; however, it is not guaranteed that teachers will be at ease because other problems will undoubtedly arise as they use these tools. Perhaps, like having computer virus attacks (Ghavifekr & Rosdy, 2015), inaccessible of internet connection (Ghavifekr & Rosdy, 2015; Noori, 2009; Singhavi & Basargekar, 2019), and malfunction of printers (Ghavifekr & Rosdy, 2015). First, having viruses in the computer cause damage, significantly if school-teacher-related files are affected. Generally, this virus disrupts the normal functioning of the computer to the extent that it damages or corruptions the software and even data saved, as mentioned. With this kind of situation, teachers who experience this will shift to traditional means as they do not have much time to consult with computer experts. Second, internet connection has become essential with the current problem the world is facing. Unlike before, offline software and tools are enough to survive in teaching. However, having no internet not only the teachers and students lead most schools to adopt the old ways again, which is printing modules and learning materials, and later being sent to every student. In most rural areas, teachers go house to house despite the long distance to reach their students. Printing machines are essential for them since those are the only resort they can teach their students. As Ghavifekr and Rosdy (2015) said, these machines can experience malfunctioning and appear in the existing problems. That is the reason why teachers keep going back instead of moving forward. Considering the study conducted by Singhavi and Basargekar (2019) in India, both teachers and students suffered too much due to insufficient resources and the public schools' set up in distant areas. Most of the far-flung areas are not built with schools even though good teachers can teach many students. Aside from the problems mentioned above, the deep concern in time constraint work overload, insufficient whiteboard and educational tools, less pedagogical models in ICT, and lack of information on the national (Hindi) language are major obstructions found in solving what so-called "deprivation in education." As reflected in many countries, the government tries to eradicate poverty, but only those know what kind of poverty they are solving.

Professional Development-Related Problems

With the demand of time, many technology tools are being developed and introduced to different schools. Sometimes, teachers are obliged to use it in their teachings. However, Arinto (2016) found out that teachers' preparedness, especially for the complex challenges, was a barrier to designing a practice for effective learning technology. This preparedness also covers the attitudes of perspective of teachers towards it.
Wong and Looi (2014) revealed emerging issues on how teachers will accept and implement new technology in their pedagogy. In detail, teachers were unsure of the proper implementation of the curriculum. Some teachers asked for help in implementing classroom questioning skills. However, educators and researchers across the globe are experimenting with new technology and various models and methods. Although guidelines do exist, there does not appear to be a single implementation method. The effect of this is just a waste of time and causing much trouble. Reality speaking, the mandate of those in the head will let teachers apply these tools; however, there is insufficient scaffolding. There might be designated experts to guide them, but it is not enough to cater to all teachers waiting. Teachers are encouraged to explore it, though it gives more anxiety for them because they do not even know how to operate it in the first place, leading them to have negative attitudes towards it.

Noori (2019) reported that teachers have moderate use of technology in their classes, reflecting having a low level of competency in using technology. Hence, a recommended that sufficient training must be organized for them surfaced. However, Ghavifekr and Rosdy (2015) documented those teachers in public schools are not given ample time to learn and execute ICT. It could be said that most of the training is complex, and e-Learning design involves integrating diverse knowledge systems (Singhavi and Basargekar (2019). There is difficulty integrating it into what lessons must be delivered to the students. Besides, Arinto (2016) said that such training programs are not enough for practitioner development in the Online Distance e-Learning or the ODL. As a result, teachers are also worried about how students will be prepared to enter another level of studies (especially college studies) (Hanımoğlu, 2018).

Nevertheless, sometimes the fault is not on the organizers who give training and workshops, but partly on the teachers. As observed, many teachers are just after the certificates, or any credentials being given after the training. Most teachers will ask if a certificate will be issued even if the training has not started. This attitude implies that they might not attend even if topics are essential without those. That is why part of the policies from the higher authority in improving the training of teachers and the contents of the curriculum (Wong & Looi, 2014) is to ensure that teachers must be knowledgeable at least at the end of every training and will increase their use of digital technology (Yeung et al., 2012). If needed, outputs must be submitted before recognizing or bestowing merits such as awards and certificates. A golden rule that organizers must note is that having a minimum number of teachers and being equipped with proper guidelines and training is better than having many groups, but no intervention is done. After all, the whole school will benefit from those training. As Mardiana (2020) emphasized, even campuses may still use standard learning practices while others continuously look for innovative ways, implying that technology implementation will depend more on the teacher.

4.3. Ways on How Technology is Integrated Inside the Classroom
Teachers are expected to use modern digital technology (DT) to improve pedagogical outcomes. Technology integration will be effective if the government, particularly in the
educational sector, implements mandated directives to develop their own "net" skills to maximize the learning benefits of technology applications. In Singapore, their officials implemented guidelines to force teachers to use DT in teaching, resulting in successful and efficient technology integration (Yeung et al., 2012). In addition, several authors said that the government must create an educational eco-system to encourage teachers to use ICT in their classrooms. Sample activities include subsidizing and organizing teacher training programs, promoting computer use, incorporating ICT into learning, and raising awareness of students in the various innovative techniques and methods that can help them develop a positive attitude toward using and integrating technology (Islahi & Nasrin, 2019; Özdemir, 2017; Singhavi & Basargekar, 2019).

Curriculum Integration of ICT
One of the essential tools for teachers is the curriculum, which acts as road maps for what should happen in the classroom. In 2018, Hanımoğlu underlined the importance of integrating curriculum development with cutting-edge technology to strengthen and tailor students' classroom skills. Teachers can collaborate with developers to create a technology-integrated curriculum when they employ technology. It is critical to educate teachers with information on new technological breakthroughs and applications that can assist in the development of more positive attitudes toward technology. As a result, there is a need to improve educational quality by using technology in education and training or workshops to help them with their classes. Also, teachers must thoroughly understand the design principle to implement it to maximize students' learning outcomes (Wong & Looi, 2014). However, Hero (2019) cautioned teachers to ensure that technology integration values are instilled and learned in a positive environment.

Utilizing Digital Literacy Skills
Moreover, a plethora of educational software has emerged and is available for free. Although, these necessities teachers to navigate and discover the software independently. Thus, it could be possible to have more technical issues and troubleshooting. With this, hiring full-time technology facilitators is highly suggested to provide innovations in schools. In addition, governments need to make good plans for technology implementation and find a suitable technology model. Therefore, there must be participation and cooperation among school officials. Hanimoğlu (2018) once said that teachers are stakeholders in the school and have direct involvement with the technology; thus, they must have a chance to share in the decision-making. The administrators' management in technology integration should guarantee everyone's inclusion from the start to the end of the curriculum.

Raman et al. (2019) stated that teachers would innovate by integrating many things into the classroom to achieve education in the 21st century. However, they need to continue to meet the needs of students of the current generation. Moreover, the teachers must try other teaching approaches to utilize technology tools and apply them in projects, especially gathering and analyzing data. Finally, teachers attend more professional development programs organized by the department of education or those enrolled in
postgraduate programs to constructively boost their emerging ICT use and knowledge content to function as agents of technological change.

5. CONCLUSION
The present study aims to know the different factors that affect technology integration and how technology is integrated into the classrooms. This systematic literature review shows that several factors can be attributed to technology integration's success or failure. First, classroom teachers' factors were directly related to technology integration concerning the use, attitude, and facilitating conditions. Second, teachers' high regard for technology translates into higher purposes in the classroom. At the same time, professional factors conveyed a more authentic relationship with technology integration. Competence among teachers in using technology was also the highest indicator of successful technology integration. These include sufficient training, deep knowledge in technology, and teaching expertise.

Consequently, tenure and directives were factors also directly affecting the successful integration of technology. As the present study uncovered, novice teachers are more adept at technology changes than seasoned and experienced teachers due to technological resistance and convenience. Therefore, directives should be given ample support, including training and time, to implement technology for personal and professional purposes.

On the other hand, despite the efforts to effectively integrate technology in the classrooms, the schools are still faced with barriers. The barriers range from the availability of support in facilities, time, and even experts to troubleshoot fundamental technological problems during classes. Moreover, teachers are further burdened with the barriers as a resolution is commonly dealt with independently. With this, the education sector is plagued by a lack of access to sufficient resources. Thus, there is a great need to transform pedagogical practices in the digital age as the needs and demands of skills change.

Finally, with the sudden shift to virtual learning caused by the pandemic, teachers must integrate and modify teaching pedagogies in technology. The researchers believed that learners' and teachers' education experiences prove we may have reached far with technology. However, the education sector still lacks directives, budget allocation, and curriculum planning for efficient and successful technology integration.
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