FACTORS AND PATTERNS OF INTERACTION TOWARDS THE DEVELOPMENT OF WEB-BASED INSTRUCTIONAL EVOLUTION TOOL FOR TECHNOLOGY INTEGRATION AMONG SCHOOL TEACHERS

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by

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LIST OF ABBREVIATIONS

ACOT	Apple Classrooms of Tomorrow
ACOT2	Apple Classrooms of Tomorrow—Today
ASEAN	Association of Southeast Asian Nations
CIE	Computer-in-Education
ERAS	Educational Research Application System
F2F	Face to face
ICT	Information and Communications Technology
ILEP	International Leadership Education Program
INSET	In-service training
JARING	Joint Advanced Research Integrated Networking
KOMTEP	Korea-Malaysia Teacher Exchange Programme
MDC	Multimedia Development Corporation
MEL-SindD	Multimedia courseware for Down syndrome
MIMOS	Malaysian Institute of Microelectronic Systems
MOE	Ministry of Education
NITC	National IT Council
ODL	Open and Distance Learning
PTA	Parent-Teacher Association
TED	Teacher Education Division
TETSI	Teacher's Educational Technology Skills Identifier
TPACK	Technological Pedagogical Content Knowledge
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
VLE	Virtual Learning Environment
UNDP	United Nations Development Programme
EPU	Economic Planning Unit
TIM	Technology Integration Matrix
FCIT	Florida Center for Instructional Technology
CK	Content Knowledge
PK	Pedagogical Knowledge
TK	Technology Knowledge

ADDIE   Analyze, Design, Develop, Implement, and Evaluate

ID   Instructional Design

GUI   Graphical User Interface

LIST OF APPENDICES

FAKTOR DAN CORAK INTERAKSI KE ARAH PEMBANGUNAN ALAT EVOLUSI PENGAJARAN BERASASKAN WEB UNTUK INTEGRASI TEKNOLOGI DALAM KALANGAN GURU SEKOLAH

ABSTRAK

Teknologi telah memainkan peranan yang semakin penting dalam persekitaran bilik darjah dengan kehadirannya yang tidak dapat dinafikan dalam pendidikan masa kini. Peratusan penggunaan teknologi dalam bilik darjah juga masih ketinggalan daripada jangkaan. Terdapat isu-isu yang belum dapat diselesaikan seperti kurangnya penggunaan platform atau perisian kursus yang disediakan, serta penolakan guru terhadapnya, masih belum dapat diselesaikan serta kekurangan bukti. Majoriti guru tidak mengetahui perisian atau laman web yang boleh membantu mereka meningkatkan pengajaran dan pembelajaran.Matlamat kajian ini adalah untuk melihat cabaran atau jurang dalam integrasi teknologi dalam kalangan guru di bilik darjah sekolah semasa dalam inisiatif tersebut.Dengan itu, corak interaksi dalam bilik darjah dapat dikenalpasti untuk membantu dalam pembentukan pengesan ukuran kemahiran teknologi potensi guru.Oleh yang demikian, bagi menjalankan kajian kes, tiga murid daripada darjah satu dan sepuluh pelajar daripada tingkatan dua telah dipilih sebagai kumpulan fokus, bersama dua guru sekolah rendah dan seorang guru sekolah menengah.Fasa pertama kajian memutuskan sejauh mana pengaruh faktor-faktor yang diperkenalkan terhadap interaksi di dalam bilik darjah. Hasil dapatan daripada fasa pertama akan dapat membantu dalam pembangunan evolusi pengajaran berasaskan aktiviti web berdasarkan kekuatan kemahiran teknologi guru dalam fasa kedua, selain meningkatkan kesedaran tentang

kepentingan penggunaan ICT serta penambahbaikan idea dan kaedah pengajaran.Mekanisme logik replikasi oleh Miller (2006) telah digunakan dalam kajian ini kerana boleh dipercayai dan telah diperakukan oleh pakar. Kaedah pengumpulan data termasuk temubual separa berstruktur untuk temubual peribadi dan kumpulan fokus, serta pemerhatian. Perspektif guru dan pelajar tentang amalan pengajaran diperoleh menggunakan temubual separa berstruktur.Data pemerhatian diperoleh dengan mengamati sesi pengajaran dan pembelajaran dengan fokus kepada interaksi antara guru dan pelajar.Kaedah analisis data perbandingan malar digunakan untuk mencari persamaan dan perbezaan antara unit data yang diperoleh daripada sumber-sumber tersebut.Analisis mendapati bahawa guru akan lebih bersedia untuk memasukkan amalan baharu dalam bilik darjah jika mereka memahami faedah apabila melibatkan diri dalam aktiviti yang akan membantu mereka meningkatkan profesion mereka.Guru akan mula mengintegrasikan teknologi dengan lebih teliti ke dalam amalan pengajaran mereka apabila mereka lebih selesa dengan alat teknologi yang boleh diakses oleh mereka.Oleh itu, adalah penting untuk melengkapkan guru dengan kepercayaan bahawa teknologi pendidikan boleh menyokong guru menjadi inventif dan berjaya sambil membenarkan pelajar belajar mengikut rentak mereka sendiri.Corak interaksi akan dapat membezakan jenis sumber yang sering digunakan oleh guru berdasarkan pilihan pedagoginya, sambil turut membantu dalam menentukan jenis alat pendidikan web yang sesuai untuk kedua-dua pola pedagogi dan interaksi.Oleh itu, melalui pembangunan aplikasi web TETSI, adalah penting untuk menentukan tahap adopsi guru bagi membantu mereka menggunakan teknologi dengan bijak berdasarkan tahap keupayaan dan kemahiran mereka. Aplikasi tersebut dapat membantu membolehkan mereka meningkatkan kemahiran teknologi mereka dari semasa ke semasa.

**FACTORS AND PATTERNS OF INTERACTION TOWARDS THE
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ABSTRACT

Technology has been playing an increasingly important role and has made its way into the classroom environment as a result of its irrefutable presence in today's education. The percentage use of technology in the classroom was still lagging behind its expectations. Unresolved issues such as underutilization of provided platforms or coursewares, as well as teacher resistance to them remained unresolved and lacking in evidence. The majority of Malaysian teachers are not aware of softwares or websites that could assist them improve teaching and learning, and just a small fraction of teachers have received professional training in ICT fundamentals. The aim of this research is to look into the challenges or gaps in technology integration among teachers in school classrooms while in these initiatives.Thus interaction patterns in the classroom can be discovered to aid in the development of an identifier of teachers' potential technology skills.As such, in order to conduct the case study, three students from standard one and ten students from form two were selected to serve as a focus group, along with two primary school teachers and one secondary school teacher.The first phase of the research will determine how much influence the introduced factors have on interactions in the classrooms. The outcomes of the first phase will be able to aid in the development of a web-based instructional evolution of activities based on teachers' technological skill strengths in the second phase, in order to raise awareness of the importance of using ICT and to

improve new ideas and teaching methods.The replication logic mechanisms by Miller (2006) were reliable and legitimate as they had been validated by experts, so were used in this study. Data collection methods included a semi-structured interview form for personal interviews andfocus groups, as well as observation. Teachers' and students' perspectives on instructional practices were gathered using semi-structured interview forms. Observation data was collected by monitoring teaching and learning sessions, with a focus on interactions between teachers and students.The constant comparative data analysis method is used to search for similarities and differences among data units obtained from these sources. The analysis discovered that teachers will be more willing to incorporate new practices in their classrooms if they understood the benefits of engaging in activities that will help them improve their profession. Teachers will begin to integrate technology more thoroughly into their teaching practice as they get more comfortable with the technological tools accessible to them. Hence, it is important to equip teachers with the belief that educational technology can support teachers in being inventive and successful while allowing students to learn at their own pace. Interaction patterns will be able to discern what kind of resources a teacher is prone to use based on her pedagogical choices, while also assisting in determining the type of web educational tools that are appropriate for both the pedagogy and interaction patterns. That is why, through the TETSI web app development, a teacher's adoption level could be determine in order to assist them in using technology wisely based on their level of capability and skill. The app should also help enable them to upgrade their technology skills from time to time.

CHAPTER 1

INTRODUCTION

1.1   Background of the Study

In Malaysia, educational technology is not new, and the educational system has been incorporating technology for almost six decades (Hafizoah Kassim & Wan Rosmini Hassan, 2021).The First Malaysia Plan, 1966-1970, indicated that unless the education system is directed toward satisfying the country's development requirements, a significant economic resource will be misallocated, slowing the rate of economic and social progress (United Nations Development Programme (UNDP), 2005). During the Tenth Malaysia Plan, initiatives were implemented to improve teacher and lecturer quality, student learning, and access to education from preschool to university levels, as well as to strengthen the education delivery system (Economic Planning Unit (EPU), 2015). Meanwhile, information and communications technology (ICT) is believed to be well-known for offering high-quality education (Dewitt, Alias, & Siraj, 2015). Hence, internet access was made available in nearly all primary and secondary schools, and teachers and principals were given access to a virtual learning environment (VLE) or platform where they could use a variety of learning tools to develop their skills (EPU, 2015).

In the Malaysia Education Blueprint 2013-2025, the Ministry emphasized on equipping schools to enable enhanced curriculum and pedagogical delivery system, with investment in ICT infrastructure being a key focus. The Malaysian government intensified its efforts on providing more ICT devices for students' ICT literacy in Malaysian schools, as well as ensuring that all teachers and Ministry officials be ICT

literate (MOE, 2013). From the Computer-in-Education (CIE) project in the early 1990s to the Frog VLE installation in the 2010s, Malaysia has launched a range of initiatives and programmes demonstrating the government's determination to improve the level of its education system by encouraging the use of technology in order to make it fit for the twenty-first century learning environment.

In 1998, the Malaysian government has encouraged the growing use of information and communications technology (ICT) in education sectors and has made major investments in e-learning initiatives in the nation. The government's Smart School Project, launched in 1998, marks the beginning of active e-learning, which was scheduled to be implemented in all schools across the country by 2020. The pilot was then determined to be successful in terms of both teachers and students, with the primary goal of improving all Malaysian primary and secondary students' learning capacity, attitudes, and success, as well as teachers' teaching performance (Kamaruddin, Hamilton, & Park, 2008; Lubis et al., 2009, UNICEF, 2014). Nearly two thousand of interactive courseware had been produced as a result of this effort, comprising Science, Mathematics, Bahasa Melayu, and English, and deployed by smart school students and teachers (Kamaruddin et al., 2008). Meanwhile, the SchoolNet Project is another government project aimed at providing schools with broadband infrastructure and Internet access (United Nations Children's Fund (UNICEF), 2014). As a result of the programme, ICT infrastructure had been provided to around 10,000 Malaysian schools. The government expected to have all schools transformed to smart schools by 2010 (Lubis et al., 2009).

The Malaysian Ministry of Education's Teacher Education Division was tasked with training teachers for the Smart Schools Programme beginning in 1998. The successful training of teachers for these Smart Schools is an important factor in the Program's success (Lubis et al., 2009). A 14-week in-service training (INSET) Course for Training Smart School Teachers was held in selected teacher training institutes to meet the staffing requirements of Smart Schools. Lubis et al. (2009) emphasized the need of teachers participating actively, passionately, and skillfully in order to improve education through the utilization of technology's benefits, which necessitates a commitment to ongoing professional development. According to a 2001 research conducted by the Universiti Kebangsaan Malaysia, smart school instruction has a moderate to high influence on smart school learners overall. In March 2008, MOE established EduWebTV as a platform to provide digital education to anyone, including students, teachers, and the general public, in accordance with the Education Development Master Plan 2006 – 2010, with the slogan 'Digital Education for All' in order to broaden its use in the country's education system. The Ministry launched EduWebTV to replace and improve TV Pendidikan transmission since it was designed to address the issue of using educational television when teachers are unable to fit it in during the school day.

In 2013, the Ministry of Education set a goal of formally designating all schools as Smart Schools provided they met minimum standards for ICT utilization, capacity, infrastructure availability, and apps that integrate ICT into the teaching and learning process (MOE, 2013). Numerous innovative ICT applications, such as 1BestariNet and VLEFrog, have been introduced into the educational system since then (Razak et al., 2018). The 1BestariNet project is an ambitious effort that promises to connect six million schoolchildren from 10,000 Malaysian schools, five

hundred thousand teachers, and 4.5 million parents to the high-speed 4G Frog VLE (Shanmugam et al., 2019; Razak et al., 2018). Since 2012, the VLE has been introduced into the Malaysian mainstream (MOE, 2015) and this specific effort is thought to be able to overcome the educational gap between city schools and rural counterparts (Awang et al., 2019; Xchanging, 2014).

Despite the fact that ICT may aid in the development of a wide range of information and cognitive abilities, a 2012 United Nations Educational, Scientific and Cultural Organization (UNESCO) research discovered that the use of ICT as a teaching tool has not evolved beyond the usage of word-processing software. In terms of both quantity and quality, ICT use in schools continues to fall short of expectations (MOE, 2013). Despite the fact that billions of ringgit have been committed for ICT in educational programmes and projects, little information regarding the efficacy and impact of previous and current activities exists (UNICEF, 2014). According to Razak et al. (2018), some surveys revealed that ICT is underutilized in Malaysian classrooms, implying that a large investment in ICT in schools does not ensure that the technology would be effectively used for teaching and learning (Wan Ali et al., 2009). Although the Smart School pilot project was deemed a success by both teachers and students, the schools reported worries about the dependability of software, hardware, and the internet, as well as challenges with electrical supply (UNICEF, 2014). Unfortunately, the offered coursewares were not used appropriately in schools and were underutilized by teachers and students (Wan Ali et al., 2009; Kamaruddin et al., 2008; MOE, 2008; MDC, 2007). Many interactive coursewares were also claimed to have failed to deliver a high-quality learning experience to students (Multimedia Development Corporation (MDC), 2007). Furthermore, when it came to implementing smart instruction in schools, less

than one-third of teachers got the help they needed from their principals (Mohammed Sani Ibrahim et al., 2002). There are probably more aspects to consider than just the rising number of facilities and digital technology installed in schools.

In 2017, the Education Technology Division identified an unresolved issue of low VLE utilization, particularly among teachers (Awang et al., 2019), thus the Ministry of Education announced in June 2019 that the Frog VLE installation in Malaysian schools would be discontinued and replaced with Google Classroom (MOE, 2019). The rationale for this discontinuation is vague; although it appeared that the decision was taken owing to a number of severe faults in Frog VLE installation, which prompted resistance, especially among teachers (Cheok & Wong, 2016; Norazilawati et al., 2013; Thah, 2014). Besides that, despite the Ministry of Education's efforts to send more teachers to courses or training to increase their ICT abilities, a lack of infrastructure has rendered these trainings ineffective (James Berok & Md. Yunus, 2019). Online resource searching, as well as the utilization of online applications and software, according to James Berok and Md. Yunus (2019), can help teachers provide excellent classes. Unfortunately, because the school's Wi-Fi had never been smooth, the 1BestariNet had failed to bridge the gap, and it had to be improved so that teachers may integrate ICT into their teaching and learning processes.

Teachers are fundamental to the teaching and learning process (Zhu, Valcke & Schellens, 2010; Vighnarajah, Wong, & Abu Bakar, 2008; McKinsey & Company, 2007; Miller, 2006). The effective integration of technology in the classroom is composed of teacher knowledge and training (Miller, 2006). According to Coley et al. (1997), the efficacy of any technology implementation is closely

related to teacher preparedness. Furthermore, Nambiar and Thang (2016) emphasized that in order for technology to be beneficial, teachers must be competent and skilled in its use. In previous studies, most teachers were identified as casual or non-users of accessible technologies since the majority lacked access, skills, and understanding to successfully use technology (Kleiman, 2000; Cuban, 1996). Therefore, it is genuinely important for teachers to expand their understanding of their field in order to become better-informed professionals (Loughran, 2006; Palmer, 2005). In addition, Nambiar and Thang (2018) highlighted the need of providing teachers with technology training. Previous research has indicated that the Ministry of Education's Teacher Education Division (TED) training programme had little influence on teacher professional development (Nambiar & Thang, 2018). They emphasized that short-term training programmes, such as those offered by the TED, would be unable to give the essential support to such teachers. However, with adequate and ongoing support from school professionals, administrators, and communities, there would be a shift in behaviour, beliefs, preferences, and attitudes about the use of technology for learning (Nambiar & Thang, 2018; Miller, 2006).

According to Kaur and Hussein (2015), teachers' struggle to learn how to use VLE had harmed the system's effectiveness. According to their research, many teachers lack the necessary skills and readiness to use the Frog VLE system. Besides that, another research claimed that Malaysian teachers' ICT knowledge is limited since they are only fluent in a few programmes that are often used in the teaching profession (Singh & Chan, 2014), and they are largely employed for simple tasks such as typing and making PowerPoint slides (Yunus & Suliman, 2014). Meanwhile, Safitry et al. (2015) revealed that 80 percent of teachers are unaware of software or websites that can help them improve their teaching and learning. Furthermore,

Ghavifekr and Rosdy (2015) discovered that only a small number of Malaysian teachers are professionally trained in the basics of ICT. According to them, one of the most critical elements influencing Malaysian society's successful adoption of ICT in education is teachers' level of ICT knowledge. Therefore, they encouraged more research into the factors influencing Malaysian teachers' use of ICT in the classrooms which can serve to improve country's teaching and learning process as a developing country (Ghavifekr & Rosdy, 2015).

Sandholtz, Ringstaff, and Dwyer (1997), on the other hand, emphasized that people should discontinue criticizing teachers for the lack of technology integration in schools without taking into account the context for teaching, teacher beliefs about teaching and learning, and professional development. Meanwhile, Miller (2006) discovered that the dominant role of the individual teacher, as well as their background, personal philosophies, pedagogical preferences, and comfort with the technological tools available to them, influenced their daily instructional decisions, regardless of whether they used technology or not. Hence, requesting teachers to adapt or adjust their pedagogical beliefs and practices is a challenging path because such practices are likely to violate their strongly held beliefs (Miller, 2006). As a result, it is essential to take a step back and examine these elements or factors that influenced teachers' instructional decisions in order to understand how they shape classroom interactions. Understanding how interaction is perceived is also important since it influences the work by defining the idea of what constitutes good interaction, as well as serving as a thinking tool (Hornbk & Oulasvirta, 2017). Furthermore, Sandholtz et al. (1991) noted that providing teachers with the most up-to-date technological tools will not contribute to significant change, and if teachers do not see a beneficial influence on their teaching, they will not commit to an innovation.

Despite the numerous programmes and initiatives established by the government, individual states, and private organisations to connect schools and communities to the internet, it appeared that the primary focus was always on providing the best practises by offering the latest technological tools for incorporating technology into the curriculum. Despite huge investments in these initiatives, there did not appear to be much analysis on the impact or progress of the initiatives (UNICEF, 2014). Unresolved issues such as underutilization of provided platforms or courseware, as well as teacher resistance to them, remained unresolved and lacking in evidence. These many perspectives reflected research-based conclusions on ICT school classroom experiences and how crucial teaching practise should be rationalised when incorporating technology into the classroom.

1.2   Problem Statement

The rapid growth of Information and Communications Technology (ICT) in recent years had resulted in remarkable advances in a wide range of disciplines, including education, and because of the continuous growth of ICT, there has been rapid progress in the development of educational technologies as well. In today's world, ICT is significant since it has the potential to give high-quality education. To realize the goal of a relevant education system in the digital era, numerous initiatives worth billions of ringgit had been created, developed, and implemented. Malaysia had launched the Smart School project as one of the seven flagship applications of the Multimedia Super Corridor in order to completely restructure the Malaysian school system and shift the culture of memory-based examination-oriented learning to a culture of thinking, creativity, and problem solving (MOE, 2001). While there is research into innovation and the integration of educational technology in schools and

educational institutions, the gap remained because there is little knowledge about the influence of such technology on the teaching and learning environment of school classrooms.

There have previously been a number of studies that sought to conduct research on the effectiveness of ICT in Malaysia, with the majority of them focused on student academic accomplishment or the ability of the innovation itself. For example, due to a variety of factors, Kamaruddin et al., (2008) indicated the Smart School courseware provided had not been used appropriately in schools and has been underutilized by teachers and students (MOE, 2008; MDC, 2007). One reason for this is the lack of interface and interaction design, to the point that many educational courseware programmes had been designed without addressing communication and interactions between students and courseware, students and teachers, and students themselves (Kamaruddin et al., 2008). Furthermore, James Berok and Md. Yunus (2019) claimed there are several rural schools in Malaysia where 1BestariNet is given as one of the Ministry's initiatives, but it is underused owing to the lack of technical support and poor infrastructure.

Meanwhile, the study by Kaur and Hussein (2015) discovered all aspects that contribute negatively to the effectiveness of Frog VLE in schools, including the length of training, teachers' focus on preparing students for public exams, ineffective internet access, and the high time consumption to generate digital online material. Furthermore, Ghavifekr and Rosdy (2015) discovered that only a small number of Malaysian teachers are professionally trained in the basics of ICT. Meanwhile, Safitry et al. (2015) showed that 80 percent of instructors are unaware of softwares or websites that might improve teaching and learning. As a result, it was obvious that

effective ICT use in teaching and learning is significantly reliant on teacher preparation (James Berok & Md. Yunus, 2019; Razak et al., 2018; Lubis et al., 2009; Abas, 1995).

As Miller (2006) pointed out, while schools across the country strived to enter the digital era of twenty-first century education, most classrooms continued to operate with a one-size-fits-all approach to the traditional education approach. Technological innovations continue to evolve, contributing to societal transformation. As a result of modern digital technology, students today are digital natives, living a media-rich, connected, and mobile lifestyle, and Web 2.0 technologies, such as social networks, have provided them with appealing opportunities for interaction and informal learning, as well as great possibilities to enhance this informal learning by deliberately integrating it into formal learning (Apple, 2008). The impact of technology on the planning and delivery of teaching to the learning process, as well as on learner interactions, may aid in a better understanding of its impact and application in schools.

Due to the nature of a researcher's role, the researcher is aware that the choice of this research topic will be influenced by both personal and professional experiences. In addition to having a background in education technology and some brief experience as a teacher, the researcher also has young children who are in the realm of schooling. The use of computers, the internet, and mobile devices in general as teaching and learning tools has always interested the researcher. Observing the children interacting with the technology and the fascination of its use amongst their peers give inspiration on how technologies can be beneficial and helpful, especially in motivating and engaging them in the learning process. In light of those interests,

the selection of specific research fields got under way, and things turned out a little differently than what was originally intended and planned. While visiting one of the rural schools, the researcher had the chance to take part in a remedial class session. This gave her the chance to witness how rarely technology was utilized in any of the school classrooms, despite the fact that there was access to the internet and technology in the building. Despite the fact that technology makes the teacher's lesson easier and faster to learn, the majority of the teachers choose not to use it to develop new methods, strategies, and approaches to teaching. This peculiar situation prompted the researcher to consider a big 'why' the teachers are hesitant to use the facilities when they have the access to use them.

Despite the fact that the government had spent billions of ringgit on ICT development in educational programmes and initiatives, UNICEF (2014) discovered insufficient information on its effectiveness and influence on past and current initiatives. Instead of focusing solely on what an innovation can provide and offer to teaching and learning, the focus should be shifted slightly to what knowledge and experiences a teacher has that influence classroom interactions in the hope that it will provide valuable information to assist them in making smart use of technology. School leaders and administrators, staff, and teacher training systems would benefit from greater insight and understanding on how technological progress influences learner experiences in the school classroom to assist and guide schools into the classrooms of the twenty-first century. It would be useful if there was an indicator to gauge teachers' potential technology skills to assist them in making smart use of technology so that a lot of information could be retrieved to assist them in becoming more effective. Therefore, further, focused research on this topic is truly essential and will be addressed.

1.3   Aims of the Study

To embrace the concept of a 21st-century classroom, students and teachers require technological school experience, therefore a deep understanding of its impact on learner experiences was also necessary to explore. This study attempted to raise awareness of the importance of using ICT as an enabler to close the digital divide between schools, as well as to assist the education community, particularly teachers, by developing a web-based instructional evolution of activities based on teacher's technological skill strengths and the improvement of new ideas and teaching methods. This study attempts to accomplish the following objectives:

1. To explore the elements or factors that influenced teachers' instructional decisions in order to understand how they shape classroom interactions.

2. To determine the most appropriate level of adoption strategy for integrating ICT into classroom lessons or curriculum.

3. To investigate how the components influencing classroom interactions and adoption strategy contribute to the development of a web-based instructional evolution tool.

4. To discover the potential and challenges of developing a web-based instructional evolution tool for technology integration among school teachers.

1.4 Research Questions

According to ACOT data, teachers will not commit to an innovation unless they believe it would benefit their teaching (Sandholtz et al., 1991). Furthermore, such understanding is crucial for driving evidence-based programme design and attempts to promote digital literacy skills in adults, teachers, children, and youth. Hence, understanding and investigating how to best use these resources to improve teaching and learning has become a challenge, especially for educators, researchers, and designers. The aim of this study is to observe, describe, and analyse interaction patterns that existed in a variety of school classrooms as a result of elements or factors that influenced teachers' instructional decisions within the classroom environment to determine whether they were affected by the use of educational technology. The outcomes of these components will be able to aid in the development of a web-based instructional evolution of activities based on teachers' technological skill strengths, as well as the improvement of new ideas and teaching methods, with the hope of raising awareness, particularly among teachers, of the importance of using ICT in the classroom.

In order to direct this research, the study will seek to answer the following research questions, which reflect the issues raised:

1. To what extent do the elements or factors that influenced teachers' instructional decisions shape classroom interactions?

2. What kind of adoption strategy is ideal for incorporating ICT into classroom lessons or curriculum?

3. How do the components influencing classroom interactions and adoption strategy contribute to the development of a web-based instructional evolution tool?

4. Is there any potential or challenges in building a web-based instructional evolution tool for school teachers to integrate technology?

1.5   Significance of the Study

When this study began by visiting a primary school learning setting, the goal was to investigate the possibilities of a blended learning programme of employing mobile phone technologies in school. The opportunity to participate in a remedial class session while visiting one of the rural schools has broadened this research interests beyond mobile learning approaches. While researching the general subject of mobile learning technology, the researcher became intrigued by a situation in which, despite the presence of technology and internet connectivity in the school, it was rarely used in the classroom. Later in the study, the researcher became increasingly interested in understanding more about the impact technology is having on both teachers and students, and how it is used in teaching and learning. The researcher's initial focus moved slightly when searching specifically on the literature of educational technology utilization in typical school classrooms in Malaysia to gain a more unobstructed perspective of the research field.

The significance of this research is that it introduces a web-based instructional evolution tool for school teachers to use in integrating technology into the classroom setting. This research aimed to raise awareness of the importance of using ICT as an enabler to close the digital divide between schools, as well as to assist the education community, particularly teachers, by developing a web-based

instructional evolution of activities based on teacher's technological skill strengths and the improvement of new ideas and teaching methods. For that reason, this study will observe, describe, and analyse interaction patterns that existed in a variety of school classrooms as a result of elements or factors that influenced teachers' instructional decisions within the classroom environment to determine whether they were affected by the use of educational technology.

The focus of this study will be on the development of a web application as a mechanism to construct a technology skill test to determine the level of teacher strength, in order to see if it will be able to help improve teacher motivation in the development of activities based on their technological capabilities. It supports the ACOT data proposition that teachers will not commit to an innovation until they believe it would help their teaching (Sandholtz et al., 1991). Aside from that, it can serve as a platform for teachers and school administrators to organize, monitor, and coordinate best practices for integrating technology into the curriculum. It will be a good start for the school to arrange technical support, instructional sharing, and collaboration where teachers can establish team teaching or develop new techniques by employing technology in the future. ICT integration entails using technological resources to assist teachers in being innovative and successful teachers while allowing students to learn at their own pace (Razak et al., 2018), and it can be accomplished by determining teachers' levels of technology integration adoption with the level's recommended web educational tools.

In addition, with the appropriate research being conducted, a proper web app system could be developed, and the future of school education system in Malaysia can benefit from this mechanism in which teachers can benefit from the use of web

educational technology based on their prospective skill or strength, in order to demonstrate how ICT is assisting them in becoming successful teachers while allowing students to learn at their own pace and need. This research, hopefully, will support the process of transforming learning to thrive in a technology-rich twenty-first century of digital generation, as well as contribute to the knowledge base of how educational technology affects students' and teachers' learning and teaching environments.

1.6   Methodology Overview

According to Robson (2011), it is always worthwhile to explore the potential of conducting some type of replication analysis, which may be from an older study or another researcher's work. The attempt to validate the structures and mechanisms described in the original study under similar contingent conditions is also known as replication, and a study may be replicated with a different target group or in a purposefully different environment to determine the generalizability of its results. Miller's research from 2006 influenced the design of this study to address the research objectives by studying how technology was influencing the learning environment of school classrooms. Replication logic explains why some parts of this research, such as methodological approaches, organization and design, and interpretation, were comparable to Miller's work. This study was reconstructed and altered using a different setting to fit with the local environment. The replication logic was employed in this study since Miller's mechanisms were reliable and legitimate because they had been validated by experts (Robson, 2011; Aguinis & Solarino, 2019). Furthermore, it is to evaluate the generalizability of its results (Robson, 2011; Aguinis & Solarino, 2019), to be able to depend on the techniques

employed in the research work (Aguinis & Solarino, 2019), and to determine whether the result can still be replicated in a different setting and environment (Yin, 2009).

The study's design evolved within the qualitative research tradition and since it is a basic design of a research that allowed for direct observation and a detailed analysis of the research setting, hence this study is presented in the form of a case study. The nature of sampling in case studies is generally purposeful or theoretical rather than attempting to be representative of a known population (Robson, 2011). Therefore, a statistical generalization is not possible. A case study, according to Merriam (1998), is known for its strengths as an appealing design for an applied field of study, such as education, and those educational processes, issues, and programmes may be explored to bring about an understanding, which can then alter and perhaps enhance practice. Furthermore, Miller (2006) pointed out that a case study allows the researcher to narrow the study topic to specific individuals, programmes, and classrooms because, as Merriam (1998) claims, it will acquire as much information about the problem as feasible in order to analyze, interpret, or theorize about the occurrence.

The methodological phase of this study was divided into two parts. The first covers the research strategy and methods of the first phase of the study, which is focusing on exploring the needs to evaluate the learners and interaction patterns in an attempt to design a web-based instructional evolution tool. The majority components from the first phase, such as methodological approaches, structure and design, and interpretation, were comparable to the previous work. The next part describes the next phase in the research which is the web application development methodologies.

The school classes in the North area are chosen on the supposition that all schools in Malaysia are equipped with adequate ICT facilities and a platform for teachers to incorporate technology into teaching and learning activities. This study employed purposeful sampling to ensure that the researcher had access to the knowledge that the study sought to investigate. The teachers were chosen for the study based on their roles and experiences in the school culture, perceived level of technology use, and willingness to share their teaching experiences. Due to study time limits and the nature of the research setting, it was difficult to monitor all classrooms or interview with every member of the community. The challenge in this study is the journey of the research itself, starting from the selection of the schools until the data collection stage implying that not every step of this research is following the plan, and not everything went smoothly.

Observations, personal interviews, focus group interviews, and document review are the four primary data collection methods; however this study only utilized the first three because the focus is more on the social component. These methods were used to gain an understanding of the interaction patterns between teachers and students in the selected classrooms. The observations phase was the most difficult to manage during the data collection stage, and two of the instructor participants requested that video recording be used instead of direct observation from the researcher. The semi-structured observations were conducted in the classrooms, and in this study, the researcher only took the observational role with the teacher's permission and request. For future contemplation and data analysis, notes were collected and expanded on. Following the observations and nearing the end of the data collection period, a personal interview with the teacher was conducted. As questions were asked in both conversational and script formats, they were adopted

from Miller (2006) but updated or amended following preliminary needs analysis. As a result, a similar procedure was employed with the students' focus group. The method of constant comparative data analysis is used to search for similarities and contrasts among data units acquired from multiple sources. To allow for data analysis, all data collected throughout the process (for example, field notes, comments, and interview transcripts) were unitized and classified using coding and themes from Miller (2006).

Several data gathering strategies were employed throughout this research project, resulting in the findings, discussion, and conclusions that will be provided at the end of the study. The first stage of the methodology is critical for sketching out the concept of what the web application is all about, who the users are, and what features it will provide. The second phase will include the characterization of findings to aid in the construction of a web-based instructional evolution tool that will serve as a platform for monitoring the level of technology adoption among teachers, as well as the workflow planning.

1.7   Operational Definitions

The following definitions are used in this study context to refer to concepts utilized especially for the purpose of this research:

Table 1.1: Operational Definitions

No.	Key Terms	Definitions
1.	Educational Technology	The "use of any technology to support the processes of teaching and learning" (Newhouse, Trinidad, & Clarkson, 2002).
		"The process of incorporating technology into education in a good way that produces a more diversified learning environment and a way for students to learn how to utilize technology in addition to their normal assignments" Hamad et al. (2018).

		Within the context of this research, education technology also refers to the use of any form of technology to aid in the overall improvement of education.
2.	Learner	The term in this study refer to students or pupils and also including teachers and other adults as well, based on Senge's concept that a classroom as a learning community consists of community members "expressing their aspirations, building their awareness, and developing their capabilities together" (Senge et al., 2000)
3.	Interaction	Two types of interaction proposed by Collins and Berge (1996) related to learning: a student is interacting individually with course content, and then interacting with others about the content. In general, there were three types of interactions identified in pedagogy: learner-to-learner, learner-to-content, and learner-to-teacher. The main focus of this research is merely on the social component of human interactions because interactions with course content are difficult to examine unless the platform is fully online learning.
4.	Pedagogy	Simply described, pedagogy is the way by which a teacher delivers curriculum content to students, including the teaching style and theories employed. Teachers may employ a variety of pedagogical approaches depending on the age of the students, the topic being taught, and the experiences they have had.
5.	Pedagogical choices	Pedagogical choices or decisions are often influenced by underlying belief systems linked to beliefs about teaching and learning, dispositions, and the knowledge and skills acquired as teachers (Yero, 2002) There are two major schools of thought in pedagogical approaches, whether teacher-initiated or learner-initiated. This study focuses on these two pedagogical approaches, whether the learning activities were teacher-centered or student-centered.
6.	Student-centred activities	A more child-centred approach, often known as a progressive approach, in which students can participate actively in the learning process (Moore, 2020). Project work and inquiry-based learning, individual and group work, and a thematic or topic-based approach to curriculum material delivery are typical strategies employed for this approach. The concept emphasizes each student's interests, abilities, and learning styles. It placed the teacher as a facilitator of learning for individuals rather than for class as a whole (Student-centered learning, 2014).

7.	Teacher-centred activities	Teachers are the major source of information in the teacher-centred classroom, also known as the traditional classroom, placing the teacher at the centre of the learning process (Moore, 2020). Whole-class teaching, rote learning, modeling, and demonstration are examples of typical methods used in this approach. Subjects are taught sequentially rather than in a topic-based manner.
8.	Level of technological integration adoption	It includes the five stages of instructional evolution in the ACOT classrooms: Entry, Adoption, Adaptation, Appropriation, and Invention. Text-based curriculum delivered in a lecture-recitation-seat work mode is first strengthened by technology and then gradually replaced by far more dynamic learning experiences for students in this model (Sandholtz et al., 1991).
9.	ACOT	Apple Classrooms of Tomorrow (ACOT) is a research and development collaboration between public schools, colleges, research organizations, and Apple Computer, Inc. that began in 1985. ACOT investigates, develops, and illustrates the transformative impact of technology in teaching and learning (Sandholtz et al., 1991).
10.	Entry	At this stage, most teachers had little or no experience with computer technology and were unwilling to change their teaching methods significantly. Interaction among teachers was essential for emotional support and for teachers to discuss their frustrations as well as their successes (Sandholtz et al., 1991).
11.	Adoption	Teachers' concerns switched from connecting computers to using them as the adoption process continued. To enhance traditional text-based drill-and-practice teaching, teachers began to use modern technological gadgets. Technical assistance for teachers is crucial in assisting them in embracing new technology and implementing it into their training, even if only as a supplement to their current educational technique (Sandholtz et al., 1991).
12.	Adaptation	The adaptation phase improved the efficiency of the instructional process. The idea is that as teachers became more at ease with more interaction between students and teachers, they began to observe each other's teaching methods and began sharing their instructional ideas (Sandholtz et al., 1991).
13.	Appropriation	Teachers' roles should have begun to develop significantly as they moved to the Appropriation phase, where an individual begins to comprehend technology and uses it effortlessly as a tool to conduct meaningful job, and new instructional patterns may have evolved. Simultaneously, team teaching, interdisciplinary project-based training, and self-paced learning became more widespread (Sandholtz et al., 1991).

14.	Invention	At this point, teachers should be ready to experiment with innovative uses for technological tools, such as designing projects that use various tools.
		Teachers' interactions are expected to evolve from emotional supports to technical assistance, instructional sharing, and, eventually, formalized collaboration, and at this point, they should be able to give supports for teachers who are still in the early stages (Sandholtz et al., 1991).
15.	Visual learning	Visual learning is a type of learning in which students use graphic aids to remember and learn material. Visual learners will benefit from seeing diagrams drawn out in class, such as on a chalkboard or in slideshows (Top Hat, 2021).
16.	Interaction patterns	There were several types of interaction patterns discovered, such as teacher to whole group, pairs or small groups, and individual work. Differentiating interaction patterns can help teachers assign distinct roles to students in the classroom and provide diverse learning opportunities for students (Zakime, 2019).
17.	Elements or factors	Elements or factors are features or characteristics of a teacher that determine how interactions take place in the classroom (Miller, 2006).
		There are five elements used for the purpose of this study; Philosophy and Pedagogy, Teacher Comfort, Interactions and Pedagogical Choices, Interactions and Education Technology as well as Learner Perceptions.
18.	Constant comparative analysis	The method of constant comparative data analysis used to search for similarities and contrasts among data units acquired from multiple sources. To allow for data analysis, all data collected throughout the process (for example, field notes, comments, and interview transcripts) were unitized and classified using coding and themes (Miller, 2006).
19.	Web application	An interactive computer programme constructed with web technologies (HTML, CSS, JS) that stores (Database, Files) and manipulates data (CRUD) and is used to do tasks through the internet by a team or a single user (Joe Johnston, 2019).
20.	Wireframing	The process of creating a blueprint for a web application is known as wireframing. Prototyping extends wireframing by including an interactive display (Joe Johnston, 2019).

1.8   A Brief Guide to the Individual Chapters

This study is being conducted to explore interaction patterns in school classrooms in an effort to raise awareness of the importance of using ICT as a tool to bridge the digital divide between schools, as well as to assist the education community, particularly teachers, by developing a web-based instructional evolution of activities based on teachers' technological skill strengths. This study is significant because it provides a web-based instructional evolution tool for teachers to utilize in integrating technology into the classroom environment in the hopes of developing profound beliefs about the usefulness of technology in today's situation. The first chapter of the thesis introduces the thesis by offering a brief overview of the research background, the significance of this study, and an overview of the methods used in conducting the research.

The second chapter examines a selection of relevant literature in order to lay the groundwork for this study and better comprehend the research project and previous research and academic works. The chapter discusses the trend and development of education technology in Malaysia including the issues and challenges, as well as the lenses of the adoption strategies model, and finally the conceptual framework employed in the study.

The third chapter discusses the methodology utilized in this study. This chapter highlighted two parts of methodology, with the first focused on the research design, data collection methods, subject selection, data analysis plan, as well as delimitations and limitations of the study. The part that follows covers the study's next phase, including a brief outline of web application development methods.

The fourth chapter contains the results and discussions as well as descriptive details of each case study. The results and findings chapter will be divided into two parts, the first determining the challenges or gaps in technology integration among teachers by determining how much influence elements introduced by Miller (2006) have on interactions in the classrooms. The findings from the first phase will be utilized to help determine the system requirement specification for the web-based application that will be created and developed. The second phase of the chapter focuses on the construction of a web-based application for an educational evolution tool based on the findings from the first phase.

Chapter five present the overall discussions and summary of the findings from the preceding chapter. The final chapter of the study which is Chapter six concludes the entire study with research implications and recommendations for further work.