THE ROLE OF VIRTUAL ASSISTANT IN THE EFFICIENCY OF ONLINE LEARNING

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A report submitted in partial fulfilment of the requirements for the degree of Bachelor of Technology Management (Supply Chain Management and Logistics) with Honours

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DECLARATION

I declare that this thesis entitled The Role of Virtual Assistant in The Efficiency of Online Learning is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.

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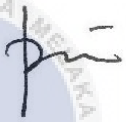
APPROVAL

" I hereby declare that I had read and go through for this thesis, and it is adequate in term of scope and quality which fulfill the requirement for the awards Bachelor of Technology Management (Supply Chain Management and Logistics) with Honours"

Signature : 

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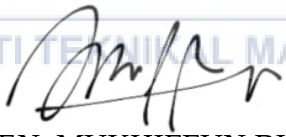
Signature : 

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DEDICATION

God Almighty, my creator and source of inspiration, wisdom, knowledge, and comprehension is the recipient of this endeavour. He has been my source of strength throughout this programme, and I have only been able to fly on His wings. As well as Dr Kamarudin Bin Abu Bakar, who served as my supervisor and gave me advice and pointed me in the right direction throughout the course of this study, I dedicate this work to my beloved mother and father, my family, friends, and other members of my immediate and extended communities for their unwavering support, assistance, encouragement, and motivation throughout the completion of this research project. I would like to take this chance to express my sincere gratitude to all my dear friends who have helped me so much with the writing of my thesis. Last but not least, I want to thank me for believing in me, for doing all this hard work, for having no days off, I want to thank me for never quitting, always being a giver, trying to give more than I receive, and just being me at all times.

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ABSTRACT

A virtual assistant refers to an AI-powered computer program or software application designed to provide support, perform tasks, and interact with users conversationally. Virtual assistants are programmed to perform various tasks, including answering questions, providing information, setting reminders and alarms, and managing schedules, especially for online learning efficiency. They can also integrate with other applications and services to perform certain actions or provide customized recommendations. Some of the popular virtual assistants include Google Assistant and Microsoft's Cortana. The purpose of this research is to see to what extent virtual assistants can affect and improve students' efficiency in online learning. Researchers also incorporated independent variables associated with the virtual assistant's role such as personal learning support, time management, and voice command. Questionnaires are structured written questionnaires that respondents must complete, with their answers often recorded in a set range of alternatives. Students in Malaysia who use virtual assistants in online learning are given a set of questionnaires. With the data from the questionnaire, the researcher Using SPSS version 27.0, we describe various statistical tests and interpretation of the analysis results. This study is presented in the form of tables, graphs, and charts to facilitate and improve the understanding of the data. several methodologies are used to obtain results such as pilot test, reliability, and regression analysis. The results of the study found that the three factors or roles of virtual assistants that were analyzed found that they were all significant and had an impact on online learning.

ABSTRAK

Pembantu maya merujuk kepada program komputer atau aplikasi perisian berkuasa AI yang direka bentuk untuk memberikan sokongan, melaksanakan tugas dan berinteraksi dengan pengguna dalam cara perbualan. Pembantu maya diprogramkan untuk melaksanakan pelbagai tugas, termasuk menjawab soalan, menyediakan maklumat, menetapkan peringatan dan penggera, dan menguruskan jadual terutama untuk kecekapan pembelajaran atas talian. Mereka juga boleh menyepadukan dengan aplikasi dan perkhidmatan lain untuk melaksanakan tindakan tertentu atau memberikan cadangan yang disesuaikan. Beberapa pembantu maya yang popular termasuk Google Assistant dan Microsoft's Cortana.Tujuan penyelidikan ini ialah melihat sejauh manakah pembantu maya dapat memberi kesan dan kecekapan pelajar dalam pembelajaran atas talian. Penyelidik juga menggabungkan pembolehubah bebas yang dikaitkan dengan peranan pembantu maya seperti sokongan pembelajaran peribadi, pengurusan masa dan arahan suara. Soal selidik ialah soal selidik bertulis berstruktur yang mesti dilengkapkan oleh responden, dengan jawapan mereka selalunya direkodkan dalam julat alternatif yang ditetapkan. Pelajar di Malaysia yang menggunakan pembantu maya dalam pembelajaran atas talian diberikan satu set soal selidik. Dengan data daripada soal selidik, penyelidik Menggunakan SPSS versi 27.0, kami menghuraikan pelbagai ujian statistik dan tafsiran keputusan analisis. Kajian ini dipersembahkan dalam bentuk jadual, graf, dan carta untuk memudahkan dan meningkatkan pemahaman data. beberapa metodologi digunakan untuk mendapatkan keputusan seperti ujian rintis, kebolehpercayaan, dan analisis regresi. Hasil kajian mendapati ketiga-tiga faktor atau peranan pembantu maya yang dianalisis mendapati kesemuanya adalah signifikan dan memberi kesan kepada pembelajaran dalam talian.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Pereira, 2023, stated virtual assistants are one area where they are very useful in education, especially online education. Until now, the use of virtual assistants in education is growing rapidly due to the Covid-19 epidemic that has hit Malaysia where all students and teachers are not allowed to go to school and instead participate in online learning. Indirectly they can learn alternatives and get to know new learning processes in class.

According to Mojard (2018), in addition to the growing number of automated evaluation tools available, a number of intervention strategies that leverage the most recent developments—such as learning analytics, educational data mining (EDM), and artificial intelligence in education (AIED)—have been put forth to support the self-regulation abilities of online students.

An intelligent personal assistant (IPA) can provide prompt, relevant information in today's technologically advanced society. Examples of IPA applications include Apple Series, Google Virtual, and Cisco Webex. With the use of this virtual assistant application, all tasks can be accessed 24/7 quickly and easily. Artificial intelligence (AI)-programmed virtual assistants can facilitate human-computer interaction using the natural language utilised in digital communication (Canbek, 2016).

Online learning is one of the important aspects of contemporary life. The increasing popularity of the delivery of educational resources to the online environment has opened opportunities for education to be more economical and widely

available (Crow, 2013). Utilising the increasingly available online learning options is crucial for students' academic, personal, and professional growth. Students must employ their self-regulation abilities to help them stay engaged with digital educational content, such as online activities or courses. Importantly, self-regulation is a learned skill that is crucial in online learning environments (Schunk & Greene, 2018).

In addition, Urdan, 2000 stated distance education includes computer-based learning, web-based learning, virtual classrooms, and digital collaboration. Online learning is a subset of this and includes a wide range of technological applications and learning methods. However, in this case, not only students and teachers are responsible compared with conventional modes of instruction, also academics bear greater responsibility for designing specific systems and procedures in an online setting (Grosse, 2004). Despite this, individuals must give themselves enough time to comprehend their various roles and duties in the newly developed classroom and education style.

1.2 Virtual Assistant

Voice-activated communication between consumers and smart virtual assistants (IVAs) is a common feature in the Internet of Things (IoT) space (Chung, 2018). In this context, humans only understand that a virtual assistant is something that focuses on voice only. This means that the user will have a say using the appropriate application. Researchers in a variety of fields, including psychology, marketing, and education, are very interested in virtual assistants, often known as chatbots, which are conversational agents. Using natural language techniques, virtual assistants are trained to communicate and engage with people through speech, typing, and visual languages (Villegas, 2021).

Although AI frequently completes specialized duties more quickly and accurately than humans, it is unclear if AI might take over the duties of a person's judgment when it comes to meeting humanity's specific requirements. Personalized help for learners could become much less viable with the advent of

artificial intelligence. During the summer, we investigated if a cognitive AI system could effectively assist prospective college freshman with adjusting to campus by engagement via personalised SMS messages (Page, 2017).

The virtual assistant has grown in popularity and number. Virtual assistants use advanced voice recognition and natural language processing to allow users to converse with them in a manner similar to that of a discussion with a human. The need to assess the state of the art in virtual assistant research was spurred by the possible privacy and data security risks associated with this procedure (Bolton, 2021).

1.3 Online Learning

For more than 20 years, education research has continuously focused on distance education as a term and as a buzzword. Education systems are undergoing rapid, drastic, and disruptive change as a result of new and existing technology for online learning (Archer, 2000). Due to the convergence of new technologies, widespread Internet penetration, and increased demand for workers who are periodically trained for the always-changing technological world, distance learning in all its forms has been expanding globally (Palvia, 2018).

Online learning is the use of education and additional support resources that can be obtained by means of computers. The computer will display the material requested by the student during an online training session. The computer will prompt the learner to search for further information, and it will provide relevant content based on his or her reaction. Learning and teaching in an online environment is, in many ways, similar to teaching and learning in any other formal educational context. The ability to change the location and schedule of instructional interactions is this context's most alluring feature (Anderson, 2008). Teachers may face difficulties while using online learning as a tool and as a means of learning about students' culture and preconceived notions.

The results of the framework of structural equations analysis showed that the virtual discussion grade and academic fulfilment of students were positively impacted by their device or digital competence and educational desire. It was also

shown that the degree to which students felt prepared for online learning based on their internet access and technological competence moderated the relationship between satisfaction with the curriculum and online learning perceptions as well as online discussion scores. Studies and online learning professionals might use the research's findings to create online courses that place a special emphasis on the web and technological their own productivity.

1.4 Research Questions

a. Is there any relationship between the role of virtual assistants and the efficiency of online learning?

b. Are the variables of virtual assistants been correctly selected to determine the efficiency of online learning?

c. What is the most important variables of the virtual assistant affecting the efficiency of online learning?

1.5 Research Objective

a. To determine the relationship between the role of virtual assistants and the efficiency of online learning.

b. To test whether each variable of virtual assistant has been correctly selected to determine the efficiency of online learning.

c. To confirm the most important variables of the virtual assistant affecting the efficiency of online learning.

1.6 Problems Statement

Virtual assistants are one of the services that have been created and used by people since ancient times. Nowadays, virtual assistants are becoming increasingly popular used by office workers, teachers, and students. According to Tulshan (2019), it has opened the way to new technology where we can ask questions to machines and can interact with a virtual assistant as humans do with humans. It is also in line with online learning and massive online courses are widely used in engineering and technology education (Pogorskiy, 2018).

Since 2020, virtual assistant services have become more widespread due to Covid-19 that hit Malaysia and other countries. Since then, students and teachers are also not allowed to go to school and had to do online learning. Various platforms are used to meet the needs and quality of learning in school. Based on My-Thanh Nguyen (2021), videos are used to record instructional content in online learning environments. Under the suggested method, the educator's speaking and face are synthesized from text and presented on slides (in PDF format) (TTS: Text-to-Speech and SDF: Speech-driven-Face).

One of the biggest benefits of virtual assistants is ensuring the highest quality in displaying lesson content and allowing them to edit lesson content directly. As a teacher, lesson content is very important because this content will be given and taught to students. The benefit of online learning is to reduce costs. Every year, students have to spend thousands of amounts of money to buy books and course materials. With the availability of online learning, students can reduce the cost of buying textbooks because students have content or learning materials online or slides.

Based on the expectation and issues facing online learning in the country, the researcher found that some students find it difficult to concentrate in class when learning online because they lack motivation. This is because online learning will cause less face-to-face interaction between students and teachers. When there is less interaction it will make students less interested in the context and the lesson at that time. Especially when MCO happens new students become more or less interested because they still don't have friends to study with. Therefore, a quantitative study is proposed to determine the relationship between the role of virtual assistants and online learning efficiency. In this case, the selected respondents are individuals consisting of

students and teachers in Malaysia. It is very interesting to expect new discoveries in research topics that can explain and confirm that virtual assistants are the best way in the effectiveness of online learning.

1.7 Significant of the study

Virtual assistants ensure that online learning has the highest quality in displaying lesson content. It is very important because high-quality lesson content can help students understand and apply the learning content in daily life.

Online learning can assess cost-effective benefits for the sustainability of the education sector. Virtual assistants can deliver messages to more customers at a reasonable cost. This means that virtual assistants can save costs, especially for parents of students because they do not have to pay high fees to buy physical reference materials.

Online learning may need virtual assistant applications to plan and execute the efficiency of online learning. To stay efficient in this era, virtual assistants need to train students and teachers to be more strategic and competitive in using applications of online learning.

1.8 Scope of the Study

The study has a few scopes that may influence its findings either directly or indirectly.

First, data collection will be limited to individuals who are involved in education such as students and teachers. Secondly, the research location selected is in Malacca and Johor only.

Thirdly, most of the respondents may need to be checked on the best virtual assistant for online learning. In line with this, the areas must also have good internet lines to ensure that the real online process can be adopted by online learning in the education sector.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, the researcher provides all the details the reader needs to understand the study. Explain the meaning of the title first. Then, each framework that the researcher provided at the beginning of the investigation is described. Readers will learn the complete structure of this research at the conclusion of this chapter.

The next chapter reviews the literature for specific terms. The researcher talks about the role of virtual assistants in online learning. You can define the dependent variable and independent variables with the aid of relevant literature by reading it. Researchers investigate scholarly publications, the internet, and other information sources to substantiate their conclusions.

2.2 Role of Virtual Assistant

A virtual assistant is a software program or application that is designed to provide support and perform tasks for users. The role of a virtual assistant can vary depending on its capabilities and the specific tasks it's programmed to handle.

2.3 Personalized Learning Support

Learning is a basic process for humans that is impacted by a variety of factors, including the surroundings, socioeconomic status, personal biases, intellectual knowledge, and circumstances. Learning has been defined as a steady, long-term increase in one's comprehension and abilities. Learning is shaped by individual interactions, including the transfer of information and skills from experiences and other people. The result of learning and tailored instruction that takes into account each student's requirements and objectives, personalized learning is a sophisticated activity method (Chatti, 2010; Miliband, 2006). According to Silva Oliveira (2018), personalized learning can be an effective strategy that raises motivation, engagement, and comprehension. Learning is therefore a personalized process that aids in expanding one's knowledge, perspective, skills, and comprehension. Consequently, customised learning models might help to fulfil individual As a result, personalized learning models can assist in meeting individual needs and objetives. Furthermore, technology integration can play an important role in personalizing the learning experience.

2.3.1 E-Learning

On the Internet, data and understanding are publicly accessible due to the rapid growth of network technology. As early as the 1980s, electronic learning (e-learning) referred to the use of electronic technology to receive educational resources or instruction via the Internet (Sangra, 2012). Initially, e-learning services were only available for text, documents, or files. The e-learning environment now supports a variety of presentation formats, including text files, graphics, video, dialogue, and multimedia (Liu, 2020). Affected by the COVID-19 outbreak, network, and multimedia streaming technology have also contributed to the expansion of the e-learning environment. E-learning is also being used in schools and by many large corporations (Sinaga, 2021). The advantages of e-learning over traditional classroom settings include shorter travel times and access to e-learning materials from anywhere at any time. E-learning materials and courses are more economical since they may be modified to match the current classroom setting, and they can be paired with digitalization to reduce paper printing (Gao, 2021). The demand for e-learning is

increasing and shifting towards more individualised and multifunctional learning, which includes collaborating online, communicating with students, integrating assessments into educational innovations, and developing educational programs to increase learning efficiency.

When organizing the e-learning procedures, e-learning materials, and learning path for an e-course, learning ability, knowledge, background, and other factors are taken into consideration. Even within the same course, it might be difficult for a uniform e-curriculum to satisfy students with various learning styles. An ineffective e-course design may increase a learner's cognitive load or cause them to become lost, which will lower learning performance and increase the amount of time needed to learn while decreasing a learner's motivation. Since no single curriculum can suit the demands of every learner, research issues on personalized learning are essential.

A learning management system offers an online learning environment where students can study whenever and wherever they want without being constrained by time or location. The most popular open-source learning management system, for instance, is Moodle (Modular Object-Oriented Dynamic Learning Environment). With open source, programmers can create functions on demand and add resources from outside sources.

Moodle, an open-source learning management system, has virtual assistants that can give personalized learning support in a variety of ways. Moodle includes several features and plugins that can be used to improve personalized learning experiences. Moodle virtual assistants can analyse learner data like as course enrolment, grades, and activities to recommend new courses or learning resources that correspond with the interests and aims of the learners. Based on their specific tastes, these recommendations can assist learners in exploring relevant topics and expanding their knowledge.

As a result, Moodle is now a popular learning management platform for universities, colleges, and other educational institutions both at home and abroad (William, 2006). According to Gamage et al (2022), in university STEM courses, Moodle is widely used and enhances outcomes for learning, student happiness, and interaction. The use of Moodle is growing, and more study is being planned.. During

the spread of COVID-19, Sinaga and Pustika (2021), used Moodle to teach and learn English lessons. Sinaga and Pustika's (2021), findings indicate a favourable perspective about the use of Moodle as a teaching tool. Students, yet, might not have self-control skills when it comes to tracking learning activities. Jeong (2012), created Middle, a Moodle plugin that uses a Bayesian network model to infer personalized training for each student.

2.3.2 Self-regulation

Increasing the achievement of pupils in the virtual classroom has been found to depend critically on developing a willingness to put in the hours independently (Mamun et al., 2022). One of the numerous methods of learning that can be employed is self-regulated learning (SRL) to enable autonomous learning in both traditional classroom settings and online learning processes (Losenno and Rakovi, 2022). Following principles, three steps make up a self-controlled online learning context: creating learning objectives and tasks in advance, carrying them out, and reviewing and analysing the results (Zimmerman, 2002). With the use of technology, these activities allow learners to control their time and study techniques while receiving instruction (Tabuenca, 2015). Students who self-regulate their learning are better able to track and improve their learning (Zimmerman, 2015).

According to a recent study (Chang, 2022), students' SRL may improve over time if a method of instruction aided by technological advances offers guidelines and a scaffolding-like structures. Nevertheless, a number of studies have brought attention to the challenges associated with putting the self-regulated online learning strategy into practice, such as creating learning supports and guidance that are tailored to the needs of specific students (McCarthy, Liu, & Schauer, 2020).

The majority of students might exhibit uncontrolled behaviour and low accountability during the learning process without the necessary direction and materials (Lu & Wang, 2022). The autonomy of the online learning environment may be dismissed by students who lack self-regulatory learning skills, and consequently, they might not finish the instructional tasks that are necessary for online classes

(Broadbent, 2020). When preparing the whole self-regulated online learning process, an instructional design that considers the unique qualities of each student may be preferable.

According to Duan, 2019, Artificial intelligence (AI) refers to computing algorithms that let systems to use behaviours, inference, and decision-making techniques to analyse, gain knowledge, and solve specific issues. The educational sector has been able to develop superior technologically improved learning systems due to AI's data analytics capabilities (Kabudi, 2021). The knowledge and intelligence of experienced teachers can be incorporated according to academics, within an education system's decision-making procedure to assess each learner's unique inference behaviours or learning status (Bhutoria, 2022). From the standpoint of individualised learning, this can assist AI in illuminating precision instruction.

"SmartStudyBot" is an illustration of a virtual assistant that promotes self-regulation in online learning. SmartStudyBot is a virtual assistant powered by AI that helps students better manage their online learning experiences. By providing adaptive help and tools, SmartStudyBot can assist with self-regulation. By modifying learning resources and materials in accordance with the needs and preferences of learners, SmartStudyBot can provide adaptive help. To improve comprehension and offer more guidance where needed, it can suggest pertinent films, articles, or interactive courses.

Example interaction:

Learner: "I'm struggling with solving equations. Can you suggest any resources?"

SmartStudyBot: "Of course! Here are some video tutorials and practice problems specifically on solving equations. They should help you grasp the concept better."

By giving instructions, reminders, and prompts, virtual assistants can support students in learning self-regulation techniques. They can help students create goals, make study schedules, and manage their time well. Virtual assistants provide learners with individualized support, which encourages them to become more self-reliant in their learning.

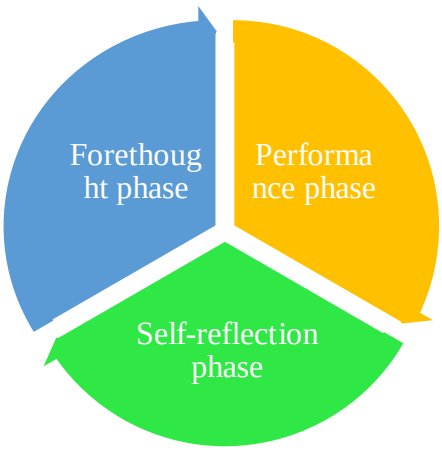

Figure 2.1: Cylinder Model of the Self-regulated learning process

2.3.3 Individualized Feedback

Virtual assistants in online learning can provide individualized feedback through various mechanisms. Individualized feedback in online learning refers to the practice of providing specific and personalized guidance to each learner based on their performance, progress, and needs. This approach tailors the educational experience to the unique characteristics and abilities of each individual, promoting a more effective and engaging learning environment. Instant feedback from personalized learning systems can assist students in recognizing and fixing errors or misunderstandings. The learning process is improved by this instant feedback loop, which also reduces the need for outside interventions.

Virtual assistants can improve the effectiveness of online learning in several ways by offering personalized feedback. For example, by personalized guidance. Depending on a student's performance, learning style, and speed, virtual assistants can provide individualized help. They can provide individualised study guides, workout plans, and other services by examining user data.

Besides, by real-time assessment. They can administer quizzes and assessments in real time, giving prompt feedback on tasks or examinations. With this instant feedback, students may focus on areas that require work and gain a better understanding of their strengths and limitations. Through goal-oriented feedback and

the encouragement of learners' self-reflection, learning tracker widgets, like this one, interact with online courses to enable self-regulated learning (SRL) (Davis et al., 2016).

To enhance online learners' self-regulatory skills, several intervention strategies have been presented that make use of cutting-edge developments in Educational Data Mining (EDM), Learning Analytics, and Artificial Intelligence in Education (AIED). These include stand-alone programs like OnTask Learning, a platform that offers personalized messages as feedback (Pardo et al., 2018, 2019), or mobile apps like MyLearningMentor, which are made to give individualized planning tools to participants in massive open online courses (MOOCs) (Alario-Hoyos et al., 2015).

According to Dousay & Hall (2018), virtual assistant platforms and apps may deliver personalized learning content, adjust to the progress of users, and give real-time feedback, all of which support individualized autonomous learning. Chatbots and virtual assistants help improve speaking and listening skills by imitating real-world classroom interactions. AI's data-driven insights also give teachers the ability to keep an eye on interventions that address particular learning needs.

2.3.4 Customize Learning

Personalized learning enables learners to advance at their own speed. They may spend more time and proceed through the content more rapidly when they understand it well on challenging concepts. This reduces the risk of boredom or frustration, ensuring that time is spent productively. In order to create sustainable learning skills, Benson (2001) emphasizes the critical role that learner autonomy plays in language classrooms. Learner autonomy has shown to be difficult to apply in real-world classroom settings, necessitating pedagogical strategies that can support students' self-guided inquiry and well-informed decision-making throughout the learning process.

At first, the main goal of these initiatives was to set up creative teaching systems that prioritize customized learning opportunities based on student input and performance. Virtual assistants provide content in formats that are appropriate for each

student's preferred learning style by analyzing their learning habits and preferences. Customization guarantees improved information absorption, regardless of the medium—visual, audio, or interactive. Virtual assistants can modify each student's learning route by monitoring progress and identifying strengths and shortcomings. By using an adaptive strategy, students can maximize their learning efficiency by concentrating on areas where they still need to improve.

Virtual assistants can offer special assistance through customized learning. To improve understanding and retention, they can provide extra materials, activities, or explanations suited to particular difficulties a student could have. Virtual assistants can adapt content for different abilities, providing alternative formats, translations, or other accommodations, ensuring inclusivity.

Indeed, although being primarily used as a platform for communication and collaboration, Microsoft Teams may be tailored in several ways to improve online learning experiences. Firstly, integration with educational applications. Lecturers can develop individualized lesson plans, tests, and assignments based on their curriculum by integrating Microsoft Teams with a variety of educational applications, including OneNote, Microsoft Forms, and SharePoint. Next, custom channels and tabs. Lecturers can designate specific Teams channels for various classes or themes. Custom tabs that connect to certain websites, tools, or learning resources can be added to any channel to provide a subject-specific experience.

Videos are used to record the instructional content in online learning platforms. The suggested method uses PDF slides with an instructor's voice and face synthesized from the text (TTS: Text-to-Speech and SDF: Speech-driven-Face) to convey the course information. In addition, guarantees the best possible quality when displaying the lesson content and enables us to edit the information straight from text instead of having to record the video anew, as is now the case (Ngoc Bich Le, 2021)

2.3.5 Lifelong Learning

Personalized learning fosters the development of self-directed learning skills, which are invaluable in a rapidly changing world. It encourages students to take

ownership of their education, making them more adaptable and lifelong learners. Computer assistance for these transitions was intended to be provided via the Personal Assistant for Life-Long Learning (PAL3) initiative. Developing an agent that can support a student throughout their career is the ultimate objective. The learner's history (including what they studied and how well they performed), their future goals, the prerequisites for success at the next level, and the resources to suggest depending on their advancement will all need to be known by this system.

On top of that, open learner models, which can be utilized to boost engagement, choose topics more wisely, and encourage metacognition, can be powered by mastery models (Bull and Kay 2010). It was essential to take into account the intricacy and interaction of the tasks because PAL3 sequences qualitatively distinct challenges (Chi 2009).

Considering that PAL3 aims to be a "life-long" learning system, forgetting also required to be taken care of by the mastery model. While forgetting for scheduling practice has been studied (Jastrzembski et al. 2009), real-time task selection has received less attention (Pavlik Jr et al. 2007), and no systems have integrated forgetting into open learner models, as demonstrated in PAL3.

For example, Google Assistant for Education. Google Assistant offers voice-activated access to an extensive library of educational materials, including vocabulary exercises and general knowledge tests. With voice commands, users can participate in lifetime learning activities, access learning resources, and ask questions. Additional examples are LearnTracker (Tabuenca et al., 2015), which tracks learning time and sends out mobile notifications to support learners' reflective practices; or virtual companions like the one suggested by Sambe et al. (2018), which is intended to offer learning indicator visualizations and metacognitive prompts.

Lifelong learning, or learning as a continuous process, the rise of informal learning, learners pursuing a variety of potentially unrelated topics throughout their lives, and the replacement of know-how with know-where due to exponentially expanding knowledge are some of the current trends in learning (Sieman, 2004). These platforms and virtual assistants are made to meet the needs of people looking for possibilities for ongoing education. In online education, they promote lifelong learning

by providing individualized suggestions, access to learning resources, and assistance in a range of topics and domains.

2.4 Time Management

In the present day of information overload, time management is becoming more and more difficult for university students. University students' primary time management responsibilities now extend beyond lectures and schedules to include more dynamic tasks including online learning, social networking, online group activities, holiday planning, and fitness management. It is emphasized that time management is more important in the lives of students (Reyal, 2021).

Virtual assistants can assist students in time management by reminding them of due dates for assignments, arranging study sessions, and planning chores. They can also shed light on a student's development by pointing out areas that may require additional time and attention.

2.4.1 Task Scheduling

Virtual assistants can assist students in efficiently scheduling their tasks and assignments. Virtual assistants make sure that learners stay organized and finish their duties on time by sending out notifications and reminders. This promotes consistency in learning and prevents procrastination, increasing overall effectiveness.

Strong time management skills are essential for success in college, especially for online classes. Using a randomized control trial of students enrolled in a for credit online course at a public 4-year university, we assess the efficacy of a scheduling intervention designed to assist students in becoming more adept time managers (Evans, 2019). The intervention had a positive effect on students' initial achievement scores, according to the results; those who were given the opportunity to plan their lecture viewing ahead of time scored somewhat better on the first quiz than

those who were not. These effects are more likely to be felt by students who rate their time management abilities the lowest (Baker, 2019).

In large-scale, high-performance computing real-time systems, task scheduling is becoming more and more crucial as the parallel size, number, and types of tasks keep growing (Han, 2021). The most effective technique for enhancing scheduling performance is the employment of prioritising policies and backfilling methods. Particularly, the task running time prediction is a key component of these approaches. Previous research has concentrated on increasing the running time prediction accuracy, which has increased time overhead and made real-time scheduling systems more challenging to install (Zhang, 2021).

One example of a virtual assistant that can assist with task scheduling for learning is Google Assistant. Google Assistant is a popular virtual assistant developed by Google and is available on various devices, including smartphones, smart speakers, and smart displays. Google Assistant can help with task scheduling for learning with calendar integration. Google Assistant can integrate with students' Google Calendar or other calendar applications. A student can ask Google Assistant to schedule study sessions, set reminders for assignments or exams, and add important dates to their calendar. It can also provide an overview of upcoming study-related events and deadlines.

In addition, Google Assistant can make reminders and notifications. Google Assistant can set reminders and send notifications to help students stay on track with their learning tasks. A student can ask it to remind them to start studying at a specific time or notify them when it is time to take a break. These reminders and notifications ensure that their aware of your scheduled study sessions and keep them focused and accountable.

2.4.2 Study Planning

Virtual assistants can help learners manage their schedules by setting up study sessions, class times, and deadlines. They can send reminders for upcoming

assignments, tests, or live online sessions, ensuring that students stay organized and never miss important events.

One example of a virtual assistant that can assist with study planning for learning is Microsoft's Cortana. Cortana is a virtual assistant developed by Microsoft and is available on various platforms, including Windows devices, Microsoft Office applications, and smartphones. Here's how Cortana can help with study planning with smart suggestions. Cortana can provide smart suggestions based on student study patterns and preferences. For example, if a student consistently studies at a certain time or duration, Cortana can proactively suggest study sessions at those times. These suggestions can help them plan their study sessions effectively and maintain a productive learning routine.

Besides Microsoft Cortona, there are another example of a virtual assistant that can assist with study planning for online learning is "My Study Life." My Study Life is a virtual assistant and study planner application designed to help students organize their academic schedules and tasks effectively. My Study Life can assist with study planning in study session tracking. The virtual assistant in My Study Life allows students to track their study sessions. They can log the subjects they study, the duration of each session, and any completed tasks or goals. This feature helps students monitor their progress, identify study patterns, and adjust their study plans as needed. Learners can schedule dedicated study sessions within the app. They can allocate specific time slots for studying each subject or topic related to their online courses. This feature helps learners create a structured study routine and ensures that they allocate enough time to cover their course materials.

University students currently find it difficult to balance their workload, which includes assignments, projects, and other duties, with their daily obligations and personal chores. It is now challenging to select how best to use their remaining time while completing things that should be prioritized (Liyanage, 2021).

2.4.3 Progress Assessment

The rapid evolution of P-12 education in today's classrooms justifies the application of efficient instruments to guarantee that every student has access to a top-notch education and advances as predicted (Bailey, 2021). To provide fair, culturally sensitive, and linguistically accessible education for English learners (ELs), it is especially crucial to plan for effective evaluation and methodical progress tracking (Orosco & O'Connor, 2014).

To monitor the pace of academic progress and assess education, progress assessment is frequently incorporated into the response to intervention (RtI) model (Fuchs & Fuchs, 2006). The RtI methodology of assessment was first intended to screen and identify kids who might benefit from intensive support as part of the Individuals with Disabilities Education Act (IDEA), which Congress amended in 2004 (Stecker, 2008). After students who may require intense intervention are identified and suitable monitoring instruments are chosen, data regarding student responses to teaching should be routinely gathered both before instruction to establish baseline data and throughout instruction/intervention (Mahdavi, 2021).

Virtual assistants can track learners' progress and provide insights into their time usage and productivity. By analysing data on study patterns and time spent on different tasks, virtual assistants can offer recommendations for optimizing time management. Learners can identify areas where they might be spending excessive time or areas where they need to allocate more effort, enabling them to adjust for better efficiency.

One example of a virtual assistant that can assist with progress monitoring for learning is MyStudyLife. MyStudyLife is a virtual assistant and academic planner specifically designed for students. MyStudyLife can help with progress monitoring by tracking grades and performance. MyStudyLife allows students to record and track their grades and performance in different courses or subjects. They can input their test scores, assignments grades, and other relevant assessments. This feature enables students to monitor their academic progress, identify areas for improvement, and track their overall performance.

Besides, MyStudyLife can help with progress monitoring by visualization. MyStudyLife provides visual representations of student progress, such

as charts or graphs. These visualizations can display their completed tasks, study time, or grades over time. By visualizing their progress, they can gain insights into their learning patterns, identify trends, and make informed decisions about their study strategies.

Depending on the requirement, subject matter, and developmental stage of the student, progress monitoring may use a variety of assessments, including diagnostic, formative, summative, or standardized (e.g., criteria, norm-referenced). Assessments can either be formal (such as exams) or informal (such as observation, conferences, or questioning tactics), or they can be a combination of both. Formal and informal assessments support the identification of knowledge gaps and the creation of individualized lesson plans (Mahdavi, 2021). Regardless of the assessment method employed, the objective is to track learning and give students immediate, accurate, insightful, and continuous feedback to enhance learning (McMillan, 2017).

2.4.4 Research Assistance

Voice-activated virtual assistants can help students locate and summarize academic papers, find and summarize research articles, and recommend relevant sources for tasks involving research. IPAs are integrated into learning management systems (LMSs) in educational settings, such Moodle (Modular Object-Oriented Dynamic Learning Environment), to support the learning of students who have unique educational needs, like those who are visually impaired. The features that IPAs provide include help with navigating the platform or the internet. IPAs provide users with information on coursework, facilitating its planning (Koon, 2020).

The goal of research assistance in the field of online learning is to investigate multiple facets in order to optimize its effectiveness. The following are some important domains where research assistance in online learning. The usefulness of various online learning platforms is investigated via research, which looks at aspects like user interface, engagement, interactivity, and adaptability to identify which platforms best facilitate learning objectives.

Research looks into instructional design models and pedagogical approaches that are most effective in an online setting. The usefulness of techniques including project-based learning, adaptive learning, flipped classrooms, and personalized learning paths is evaluated in this study. Pedagogical educational and training approaches, like instructors participating in their pedagogical training (Rosado-Pinto, 2008), tutoring, and project-based learning (Veiga Simao et al., 2008; Sim, 2002), have an impact on students' learning and integration in postsecondary education (Lopes and Mesquita-Pires, 2013).

The Educational Resources Information Center (ERIC) created an online virtual assistant called AskERIC. It was created to make it easier for students, teachers, and researchers to locate educational materials and data. Though it may have changed or been supplanted by more recent systems since it was in use, it provides a historical illustration of a virtual assistant in the education sector that is research focused. Users of AskERIC were able to post questions on curriculum development, instruction, and other educational subjects. The virtual assistant provided curated resources, research papers, teaching guidelines, and references from ERIC's vast database, using natural language processing to comprehend requests.

While AskERIC might not be currently active or might have undergone transformations, its model represented how a virtual assistant could support research in online education by offering access to educational databases, curated resources, and assistance in finding relevant materials for educators, researchers, and students in the education field.

2.4.5 Time Blocking

Students can set up certain time slots for attending classes, taking breaks, and studying with the aid of virtual assistants. As a result of this method, students are guaranteed to have a well-organized daily schedule. Another example is NoteMyProgress, which lets students manage their notes, keep track their tasks on the educational tool, and measure how much time they spend studying both within and outside of the platform (Pérez-Álvarez et al., 2017).

When referring to a virtual assistant for online learning, time blocking refers to setting aside particular time slots for various assignments or learning activities in an online learning environment. This method facilitates efficient time management and organization for educational objectives. Here is how virtual assistants might work for online education. The first is task allocation. It helps divide more complex jobs into smaller time-bound chunks, such as doing homework or going over course materials. One hour may be set aside for doing exercises, and the other two hours could be devoted to reading the course materials. Then, establishing learning routines. The virtual assistant helps create regular learning schedules by allocating specific time slots for reading, writing, participating in online forums, and participating in group projects.

High levels of student satisfaction are also produced by IPAs since they allow students to attend instruction at their convenience and receive tailored feedback. PExA's component offers the user tailored time-management assistance that adapts to her needs and preferences and can change with the situation (Berry et al. 2006). PTIME uses a combination of advice-taking, active learning, and passive learning to understand its users' preferences.

Besides the Note My Progress, Google Calendar also can let users schedule time for online classes, tasks, and study sessions. Reminders and recurring events can be created by users to create a structured study schedule and Microsoft To-Do also may students assign time slots, make lists, and set assignments for various educational activities. It integrates with Outlook and other Microsoft programs to provide a smooth scheduling experience.

For online learning, they provide tools and features that make time blocking and productivity management easier. To efficiently manage their time for educational activities, users can incorporate these tools into their study habits and take advantage of their scheduling features. Online learners can improve their time management, focus, organization, and consistency in their academic endeavors by utilizing time-blocking techniques with the help of a virtual assistant. This method promotes an organized approach to online learning and maximizes efficiency.

2.5 Voice Command

There has already been a shift in the way education is delivered, with a significant impact from internet technologies. The Internet has fostered a content culture that is critical to the growth of social learning, claim Brown and Adler (2008). Web 2.0 has made it possible for people with similar interests to interact and exchange ideas through new online resources like social networking sites, blogs, and virtual communities, while Web 1.0 has significantly increased access to information (Brown and Adler, 2008, Maloney, 2007). According to Mason (2006), Selwyn (2009), Tapscott and Williams (2010), and other research, social network apps can dramatically enhance students' learning and information acquisition by facilitating interaction, collaboration, active involvement, resource sharing, and critical thinking.

2.5.1 Communication

By acting as the person in the middle, virtual teaching assistants can assist in maintaining student-teacher contact. By acting as the person in the middle, virtual teaching assistants can assist in maintaining student-teacher contact. Teaching assistants can answer students' questions, record feedback, identify at-risk students, and report any other difficulties to the teacher.

According to Buckman (2005), Facebook users use the site to share images, personal opinions, and views, join groups with similar interests, and stay in touch with those who live far away. Other online platforms, such as MySpace, are also used to communicate with individuals, but the Facebook platform is more extensively used since it is seen as the main social network that offers the most benefit to students (Golder, 2017). According to certain research, more than 90% of university students use this social network as a learning tool (Ellison, 2007). According to Muniz (2009), Facebook can have a good impact on the lives of kids. Students, for example, use Facebook to contact other students to better fulfil prescribed assignments and participate in cooperative projects. Not only students, professors can also use it by forwarding useful links to students related to the learning topics they are studying.

Virtual assistants enable continuous communication and support throughout the day, regardless of time zones or working hours. This 24/7 availability ensures that students have access to assistance whenever they need it, eliminating delays in addressing their queries or concerns. They can engage with the virtual assistant at their own pace, leading to uninterrupted learning and increased efficiency (Gregory R. Berry, 2019).

Interacting with each individual student, according to Istrate, 2019, is one of the most time-consuming actions during language instruction. As a result, new artificial intelligence technologies are being developed that can replace teachers and pair up with each student, forming a personal relationship with them, assisting them in improving their pronunciation and vocabulary, and even allowing them to speak with other students. This allows us to discuss the coach swiftly and readily, and it can also serve as a virtual peer for the student.

Previous research indicates that educators have tried using Twitter to teach a variety of courses in college settings. Welch and Bonnan-White (2012) conducted an experiment at Western Illinois University in the USA, teaching undergraduate students enrolled in Sociology and Anthropology courses. Jones (2015) used Twitter in a University of California literature class of thirty undergraduate students. Yuan (2012) used Twitter to teach English at a Taiwanese college. Luttrell (2012) examined the efficacy of Twitter in delivering a Public Relations course at a Midwest-based university.

Virtual assistants facilitate personalized communication by tailoring responses and recommendations to individual students. They can analyse students' progress, performance, and preferences to provide customized suggestions, feedback, or study materials. This personalized interaction helps students focus on their specific needs and optimizes their learning process, resulting in higher efficiency. These aspects collectively contribute to the efficiency of online learning by facilitating seamless information exchange, supporting individual needs, and promoting a productive learning environment.

Finally, virtual assistants can aid students with communication by giving them quick and easy access to information and assisting them with work like scheduling, organising, and managing their time. Language learning, for example, can

help students learn new languages by providing interactive language courses, quizzes, and vocabulary exercises. This can assist pupils enhance their communication skills and develop their language capabilities. As a result, virtual assistants can be a wonderful resource for students looking to enhance their communication skills and thrive academically.

2.5.2 Multimodal Learning

Because learning analytics bridges the gap between humans and computers, educational scholars with a focus on learning theories can collaborate with technologists to develop cutting-edge techniques for multimodal learning analytics, which can then be implemented by organisational managers to enhance online learning. Thus, developing lesson plans and technological options for tracking students' learning trajectories requires a careful instructional design based on a thorough assessment of students' learning skills. This is how learning analytics, based on a fast examination of the collected data, can assist in designing an adaptable instructional design (Ayeha, 2019).

Voice command functionality complements other modes of learning, such as visual or hands-on activities. Students can use voice commands to retrieve audio content, listen to lectures, or engage in interactive conversations related to the learning material. By incorporating voice interaction alongside other modalities, virtual assistants create a more immersive and comprehensive learning experience.

A computer programme, a robot, or a solution to an engineering problem are just a few examples of the types of learning tasks that could benefit from the use of new high-frequency data collection technologies and machine learning analysis techniques (Bakers, 2004). To present, most of the research on learning analytics and educational data mining has been on online courses or cognitive tutors, where the interactions are entirely conducted in front of a computer and the activities are more regimented (Amershi, 2009)

Multimodal learning with a virtual assistant allows for a complementary combination of various modalities. For example, a virtual assistant can display visual

representations of concepts while providing spoken explanations or demonstrations. This synergy between different modes reinforces learning and facilitates a more comprehensive understanding. Students can benefit from the strengths of each modality, enhancing their overall learning efficiency.

One example of a virtual assistant that incorporates multimodal learning for online learning is LearnSmart. LearnSmart is designed to support students in a variety of subjects and provide a comprehensive learning experience. LearnSmart utilizes multimodal learning by visual learning. LearnSmart offers visual learning materials, such as interactive diagrams, infographics, and charts. For example, in a biology lesson, LearnSmart can display visual representations of cellular processes or anatomical structures, allowing students to grasp complex concepts visually.

Besides, LearnSmart utilizes multimodal learning through audio support. LearnSmart provides audio support to enhance auditory learning. It can read out text-based content, provide spoken explanations of concepts, or narrate lessons and stories. This audio support caters to learners who prefer auditory information processing and reinforces understanding through verbal reinforcement.

According to M Sankey, 2010, to help with this, the growing use of multimedia in the classroom has created several chances to offer content in various forms (text, video, audio, graphics, and interactive features), better accommodating the various learning preferences of an increasingly varied student body. Through the integration of visual learning materials, audio support, interactive simulations, video tutorials, text-based resources, quizzes, assessments, and personalized recommendations, LearnSmart harnesses multimodal learning to create a comprehensive learning experience. This multimodal approach caters to diverse learning preferences and optimizes the efficiency and effectiveness of online learning for students across various subjects.

2.5.3 Engage Learners

This study uses virtual educational aids as an evaluation and remediation device to support online learners in staying involved in their learning environments

through the use of an adaptive support tool, which was created to enable students to carry on with their online education (Pogorskiy & Beckmann, 2022). Learners must make use of their self-regulation abilities in order to sustain interaction with virtual learning materials, such as virtual classes or programmes.

Virtual assistants use a range of interactive, tailored, and encouraging techniques to help learners become more involved in online learning. Personalized Learning Paths. Based on an individual's interests, skills, and preferred method of learning, virtual assistants evaluate learner data to make recommendations for activities, resources, and courses. Interactive Learning Experiences: They make learning more dynamic and participatory by facilitating interactive learning through discussions, games, simulations, and quizzes. Encouraging a feeling of social presence when engaging in online activities might help reduce feelings of loneliness. The frequency of online contact can rise with increased social presence (Tu & McIsaac, 2002). For example**,** Kahoot games engages learners through gamified quizzes and challenges. Educators can create interactive quizzes on various topics, fostering engagement and competition among learners.

In addition to lacking self-regulation abilities, online learners also experience feelings of loneliness (Chametzky, 2021) because there aren't many interactions with other users in the virtual environment (Wut, 2021). For instance, a student might post a question online or seek assistance with a class task, but they might not receive a response from others. Virtual assistants can increase learner motivation and achievement by using these tactics to actively include students in online learning. This results in a more engaging, supportive, and individualized learning environment.

2.5.4 Controller

Smart devices are common in the households of many students. Voice commands can be used to operate these gadgets, change the temperature, light levels, or play relaxing background music while studying. Students also can control various study aids, such as flashcards, quizzes, or voice-guided tutorials, through voice commands. This makes the learning process more interactive and engaging.

The use of this technology in education might be advantageous since it makes it possible to assist all of the course participants by answering questions, guiding them through the material, and suggesting exercises (Parenti, 2017).

Google Assistant can function as a voice controller for online learning by allowing users to connect with educational content and platforms using voice commands, to its natural language processing and speech recognition capabilities. Here's how Google Assistant can work as an online learning voice controller. The first is access to educational content. Users can ask Google Assistant to look up particular courses, educational subjects, or online resources. For example, people could say, "Hey Google, look for programming language courses," or "Ok Google, look for biology tutorials."

Next, navigation and access. Using voice queries, Google Assistant may assist users in navigating around educational websites or learning platforms. Users may tell it to "Open Coursera and enroll in the psychology course" or "Go to my learning dashboard," for instance.

While Google Assistant might not have direct integration with all learning platforms, its ability to perform web searches, access information, provide explanations, and assist with tasks using voice commands can significantly support learners in their online education journey. Integrations with specific educational platforms and applications may further enhance its capabilities as a voice controller for online learning.

The Android voice assistant has garnered significant attention in recent years due to its continual development, wide range of applications, and significant theoretical value (J.Wang, 2021). These days, smartphones are able to comprehend speech directly and comprehend concepts without the need for user input. It is the primary trend in intelligent device application development. For certain smartphone users, voice interaction enables input, question, and control functions using the Android voice assistant (T.Asami, 2019). In addition to increasing input efficiency, general applications like the voice input technique might free up space in certain unique contexts to accommodate users' input requirements.

2.6 The Efficiency of Online Learning

Online learning, sometimes referred to as virtual education or remote education, is a way of obtaining training, abilities, or knowledge using digital mediums via the Internet. Lieberman (1995) made the argument that a user looking for meaningful knowledge requires a type of smart support. It involves accessing educational resources, instructional materials, and interactive learning experiences online without the need for physical presence in a traditional classroom setting. Online learning can take various forms, including virtual classrooms, online courses, Massive Open Online Courses (MOOCs), and blended learning.

Effective student assistance is a critical component in improving students' learning experiences, with the ability to promote retention, progression, and student accomplishment. In every educational surroundings, one of the most important factors influencing how well students do is student support (Rovai, 2010). Organizational encouragement, relationships with individuals, and approaches to online learning are all considered forms of student support, according to Moore and Kearsley (2005).

There is considerable variation in the way that students view their experiences with online learning (Berge, 2005). In a similar vein, students' responses to learning-supportive student resources could vary. It is hypothesised that students' views of support are influenced by transactional distance, which therefore shapes their educational experiences. It is true that perceptions of learning, which include course satisfaction, accomplishment, and learning outcomes, are correlated with students' opinions of help (Mullen, 2006). In order to minimise transactional distance and maximise student learning, learning environments should offer the proper support, as well as an appropriate framework for the course contents and activities, as well as efficient communication techniques.

Online learning offers several advantages, including flexibility in terms of time and location, access to a wide range of educational resources, personalized learning experiences, and the opportunity to learn at one's own pace. It has gained popularity in recent years, particularly due to advancements in technology, the availability of high-speed internet, and the increasing demand for lifelong learning opportunities.

The vast amount of information that can be accessed online by students provides highly personalized learning opportunities. Additionally, virtual assistants can be trained to repeat different parts of the lesson, providing students with a personalized learning plan. These benefits are just one advantage of using virtual assistants in language classes. This study aims to educate the process of training virtual assistants to fulfil classroom requirements. The idea is to learn how to train virtual assistants so that learners can take charge of their education. Therefore, the virtual assistant will help students attain the communicative way of language acquisition, where they are left to understand the concept and the grammatical structure while the teacher just guides the class, focusing on the most appropriate assessment and ultimately facilitating the learning process.

Measuring the efficiency of online learning can be done using various metrics and indicators. Some commonly used method and factor for measuring online learning efficiency is learning outcomes. One key measure of online learning efficiency is the achievement of desired learning outcomes. This can be assessed through evaluations, quizzes, exams, or projects that measure learners' understanding, knowledge retention, and application of learned concepts. Comparing learners' performance before and after the online learning experience can provide insights into the effectiveness and efficiency of the learning process.

The claim that online courses provide similar student results to those of in-person courses is supported by just scant data. Numerous researches have examined how well students do in face-to-face versus online classes, but most of these comparisons have been descriptive studies without safeguards against student self-selection. Furthermore, the bulk of them have concentrated on groups or settings that are unrelated to the usual online college course. College courses that last for an entire semester have received little attention from random-assignment or quasi-experimental studies (Figlio, 2010).

Numerous research have looked into how learners' demographic backgrounds affect the results of their online education (Gasevic, 2016). The effects of gender (Boyte-Eckis, 2018) and educational attainment (Diep, 2016) on the outcomes of online learning have been the subject of numerous studies. While the

impact of gender on online learning results is debatable, educational degrees have the potential to predict online learning outcomes quite well (Huang & Fang, 2013).

A statistical difference across course formats was found in the final model, which corresponded to a minor difference of less than 0.07 GPA points on a 4-point scale. The student's GPA had the biggest impact on their particular course marks. It's interesting to note that a model-based interaction between course type and student GPA revealed a cumulative effect, meaning that higher GPA students will perform even better in online courses (or, conversely, lower GPA struggling students perform in online courses as opposed to in-person courses).

Next indicator to measure the efficiency of online learning by completion rates. Completion rates indicate the percentage of learners who successfully complete an online course or program. Higher completion rates generally indicate a more efficient learning experience. Monitoring completion rates can help identify any potential barriers or challenges that hinder learners' progress and take steps to address them, improving the overall efficiency of the online learning process. Low completion rates, however, are a typical issue for many online learning environments, frequently as a result of a lack of assistance (Reich & Ruipérez-Valiente, 2019; Xu et al., 2018). Learners must apply self-regulation in order to sustain involvement with virtual instructional materials such as webinars or classes.

Adult learners' course completion rates in online courses have historically lagged behind those in traditional classroom settings (Rovai, 2002). Compared to typical college classroom courses, online university courses have 10%–20% higher dropout rates (Carr, 2000). Adult learners' struggles with tenacity, feelings of isolation, and a lack of support from their instructor and learning community are frequently cited as barriers to finishing online courses for university credit or continuing education (Rovai, 2002). Massive open online courses, or MOOCs, are a new kind of online course structure and platform that allows thousands of students to receive instruction at once. However, MOOC completion rates are not nearly as high as those of online or comparable university classroom courses (Watters, 2012).

Despite the fact that millions of adult learners have signed up for MOOCs, there are currently few empirical studies that look at MOOCs and their educational value. It is impossible to ignore the criticisms levelled at MOOC completion rates,

which can average less than 5% of registered participants (Balch, 2013). Using publicly available data, a recent unofficial study looked at the enrollment and completion rates of MOOC participants. According to this analysis, MOOC enrollment averaged about 50,000 students, and the majority of MOOCs had completion rates of less than 10% (Jordan, 2013).

Although it may seem obvious that online courses are always less expensive than in-person courses, there is surprisingly little data comparing the costs of online versus in-person courses. Most of the pertinent research is out-of-date (Jung, 2003), and the conclusions are also inconsistent. Rumble, 2003, studied the difficulties in drawing generalizations regarding costs among various course kinds and educational establishments and concluded that the question of whether online courses are indeed less expensive cannot be answered with certainty.

The main motivations for adopting online learning are to lower costs and increase the educational value while simultaneously increasing access to training and improving learning quality (Bates, 1997). The two primary settings in which online learning is offered are synchronous and asynchronous (Jolliffe, Ritter, & Stevens, 2012). The advantages of asynchronous learning over synchronous learning on online platforms include the flexibility to access information at any time and from any location, the capacity to reach a larger audience simultaneously, and the consistency of the content. Both industry and academics have effectively employed online learning in conjunction with in-person instruction, with positive results (Chang, 2016).

2.7 Research Framework

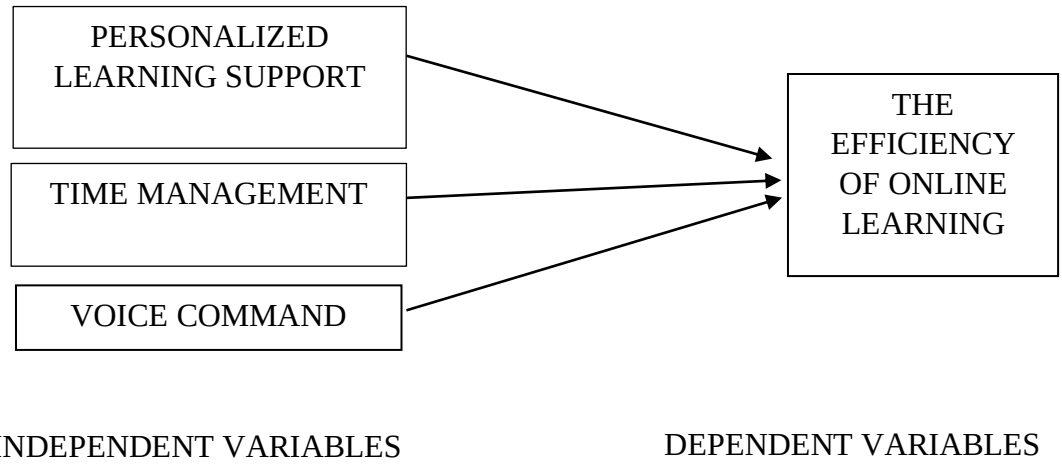

Figure 2.2: Research Framework

2.8 Research Hypothesis

These hypotheses were created based on the suggested research framework to answer research questions and attain the research objectives:

Hypothesis 1:

There is a significant relationship between personal learning support to the efficiency of online learning.

Hypothesis 2:

There is a significant relationship between time management to the efficiency of online learning.

Hypothesis 3:

There is a significant relationship between voice command to the efficiency of online learning.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The methodology employed by the investigator to gather the results of their study is outlined in the third chapter. The researcher described in this chapter the procedures and methods that were already decided upon to be employed in order for the study to be legitimate. The entire process has been discussed in detail. The study design, research population and sampling, data collecting and analysis procedures, pilot testing, and a chapter summary are all covered in the first section of the methodology chapter.

3.2 Research Design

The study design determines the data collection, measurement, and analysis strategy. It is the general strategy used by researchers to combine the many components of the study rationally and cohesively, ensuring that the researcher controls the research issue efficiently. The fundamental idea of the researcher's approach to answering the question is referred to as the research design. Identify the sources from which researchers must collect and evaluate data in accordance with the objectives, look into ethical dilemmas, and deal with the unavoidable limits that researchers must work within, such as time, money, location, and data access (Saunders et al., 2016). Therefore, the design of the study relates to the overall strategy of the research scientist in combining the many portions of the analysis using the most obvious and accepted procedure.

For this study, the researcher applied the methodology of descriptive research. A descriptive research design is one that systematically gathers data to characterise a group of people, situation, or phenomena. More specifically, it assists in addressing the what, when, where, and how rather than the why of a research topic. There are two methodologies that can use for conducting this research which are qualitative data and quantitative data.

3.3 Research Method

As previously said, the researcher gathered data and conducted research using quantitative methodologies. The systematic investigation of trends through the gathering and evaluation of statistical and graphical information is known as quantitative research. For instance, in this study, a researcher uses sampling techniques to get data from students and teachers by sending out online questionnaires, surveys, and polls. Many approaches from multiple fields have been modified for implementation in futures studies, according to specialists in the field (Bell, 2003). Futures study a highly flexible subject of study with many possibilities to achieve so, it might be claimed.

3.4 Location Research

The areas selected for this analysis can be used for more research, especially in terms of sampling and population selection. The researcher decided to conduct this study in Malacca and Johor to ensure a better and more effective distribution of questionnaires and more accurate results. To contact the respondents, who are in Malacca and Johor, questionnaires created in Google Forms and distributed via WhatsApp, Telegram, and Instagram.

3.5 Research Strategy

The researcher's methodology and analytical approach impact how information is gathered and the interpretation that is made, hence research strategy is critical. This section discusses data-collecting research methodologies such as surveys, questionnaires, population and sample, and pilot testing.

3.5.1 Survey Method

Survey methods are defined as "the gathering of data from a selected group of people by their answer to surveys" by Check and Schutt (2012). There are numerous methods available for recruiting participants, gathering data, and conducting this type of research. and employing a wide range of instrumentation technologies. Data collecting procedures are significant because the researcher's methodology and analytical approach impact how information is gathered and how it is interpreted.

Historically, survey methodologies entailed the gathering of enormous volumes of data pertaining to populations. This kind of survey study's main objective is to quickly gather data on the traits of a sizable sample of people who are of interest. Consumer feedback surveys and large-scale census surveys that gather information on personal and demographic characteristics are suitable examples. These surveys are often sent out by social media platforms and are intended to describe a person's demographic traits or to get feedback on potential products or programmes for a community or group.

3.5.2 Questionnaire Method

In survey research, the most common methods of gathering data are surveys and interviews. Surveys can be conducted in groups or individually, by a professional or by the participant themselves, and frequently include a series of items that correspond to the objectives of the research. Questionnaires may include demographic information in addition to precise and trustworthy research tools

(Costanzo, Stawski, & Almeida, 2012; DuBenske et al., 2014; Ponto, Ellington, Mellon, & Beck, 2010).

A questionnaire is a kind of research tool made up of a list of inquiries or other kinds of cues intended to get information from participants. Depending on the type of inquiry, questionnaires can be divided into two types: quantitative and qualitative. Typically, research questionnaires include both closed and open questions. Questionnaires are the most used method for obtaining primary quantitative data. A written, methodical questionnaire is what is called a questionnaire, and it is completed by the respondent. The quantitative method will acquire responses through closed questions with multiple-choice answer alternatives. Tabulations, pie charts, bar charts, and percentages can be used to illustrate the study's conclusions in this scenario.

This questionnaire contains three closed-question sections. The first component found in the researched questionnaire is related to the respondent's profile such as gender, race, age, and level of education. The components in the second part of the questionnaire that were studied were independent characteristics related to the research objectives such as personalized learning support, time management, and voice command. Next, the component in the third part of the researched questionnaire is related to the dependent variable, which is the efficiency of virtual assistants in online learning.

The Likert scale has 5 scales. It ranges from "strongly disagree" to "disagree" to "somewhat" to "agree" to "strongly agree". The Likert scale will be evaluated in the second component part and the third component part. Google Forms, which is an internet programmer for online techniques, was used to construct and customize the questionnaire.

Table 3.1: Likert Scale with five-point

Strongly Disagree	Disagree	Somewhat	Agree	Strongly Agree
1	2	3	4	5

3.5.3 Population and Sample

The population is the total group from which the researcher requires to gather findings. A sample is a subset of the population from which the researcher gathers data. The sample size is always smaller than the whole population. The sample frame was the list of all study participants. It is a thorough list of all issues about which scholars want to learn more. The sample frame is more particular than the population since the latter is more generic. In this study, the researcher used Krejcie and Morgan Table to determine the sample size.

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

Figure 3.1: Determining Sample Size from a Given Population

(Source: Krejcie and Morgan, 1970)

3.5.3.1 Population

A complete group for which information must be determined is referred to as a population. A statistical population does not have to be made up entirely of people. The research question or the goal of the study will provide recommendations for the population type that is appropriate for the study in terms of geography and restriction to a particular age group, gender, or occupation. To properly state the responses to be included and excluded (inclusion and exclusion criteria), the population must be fully defined.

The target population identifies a particular group or subject that the researcher is interested in, requiring further investigation and analysis of their findings. The audiences that the researchers are targeting for this study are students and lecturers studying and teaching at Malacca and Johor. Based on the city population, the estimated population of Malacca is 1,027,500, and the estimated population of Johor is 4,100,900. Then, because the population is more than 5 million, the target population will be 1,000,000 based on Krejcia and Morgan table.

3.5.3.2 Sampling

A sample is a subset of a population chosen to be representative of the entire population. By using a representative sample, we may lower the costs paid, the time required to conduct the research, and the manpower required to carry out the study. Sampling methods should be methodical and defined so that reliable conclusions may be drawn from the sample. Three elements influence sample representativeness:

1) Methodology of sampling

2) The sample size

3) The response rates

The two types of sampling methodology are probability sample and non-probability sample. The highest standard in sampling methodology is probability sampling, which also guarantees the generalizability of study findings to the intended audience. Every member of the population has an equal chance of being chosen for the

study using probability sampling. In a non-probability sample, subjects are chosen with an unknown probability, which introduces bias into the study's selection process. Non-probability samples also have the disadvantage of not knowing the target population, which makes it challenging to provide an answer to the study question.

The sample size in an experiment or survey is a percentage of the population. Any empirical study that aims to collect data from a sample must consider the sample size. Consequently, based on Krejcia and Morgan table, the target population for more than 1,000,000 need 384 respondents were required to reach the target population for this study.

3.5.4 Pilot Testing

Pilot testing is a type of software testing that involves putting the system's components through their paces in a real-world setting. Pilot tests are used to assess the feasibility, duration, cost, risk, and performance of research projects. In other words, the effectiveness and quality of larger investigations can be improved by doing pilot studies. The researchers chose 30 virtual assistant-using students and instructors for the pilot trial. The researcher will also test questionnaires for the research study on the respondents. The researcher will need around a week to do this exam. Opinions and recommendations are considered and incorporated into the survey's final questionnaire. Instead of providing the questionnaire to the respondents in this study, a pilot test should be carried out and data collected.

The data from this pilot test was also evaluated using the SPSS tool to see how precise and pertinent the questions were when they were later presented to the responders. The researcher created a new pertinent inquiry to take the place of any questions that did not fit the normal level.

3.6 Time Horizon

A decision-maker's time horizon is the distance into the future that they consider while assessing the potential outcomes of a suggested course of action (Ebert, 1973). The research's temporal frames are specified by the temporal Horizon. cross-sectional or short-term research, which involves gathering data at a particular moment in time. A study may be carried out to address a research problem in which data are gathered once, occasionally over the period of days, weeks, or months. These investigations are called one-shot or cross-sectional studies. The longitudinal time frame involves gathering data continuously over an extended period of time in order to compare it. Occasionally, the researcher may decide to look at people or events across a period of numerous time periods in order to thoroughly address the research issue. For example, the researcher could compare employee behaviour prior to and following a change in top management to ascertain the effects of the change. Since data for this study were gathered longitudinally over an extended period of time rather than cross-sectionally or in a single shot, it is neither of those types of studies. These kind of inquiries, which include gathering data on the dependent variable over two or more time periods in order to address the research question, are referred to as longitudinal studies.

For this study, the researcher used the cross-sectional time horizon method. The study period is no more than one year; therefore, it is a short-term study. The researcher will obtain information and research answers from respondents within a certain period only, for example within 2 weeks the researcher will get answers from 384 respondents around Malacca and Johor.

3.7 Data Analysis

Science uses data analysis to explore and experiment with data using a more advanced methodology and state-of-the-art methodologies. However, in a business context, data is utilised to support decisions that are driven by data and can increase an organization's productivity. Data analysis is, in general, the process of gathering, modelling, and analysing data using different statistical and logical methodologies. It is a technique for disassembling data to reveal its distinct features and organisational structure. The material gathered was interpreted by the researcher

through analysis and evaluation. Since this study collected only quantitative data, each type of data was evaluated separately. Data collection and processing by researchers took place in stages, with preliminary data. Data from reports and committee minutes were used as a starting point for early data analysis and further data collecting. The questionnaire transcripts were the main source for the researcher's data analysis. To analyse the data and address any instructive issues that surfaced throughout the sorting and categorising procedure.

Using descriptive analysis, the variables of central tendency and dispersion were compared and characterised. Descriptive statistics, which comprise the mode, median, and dispersion, which shows how data values are spread at the trend centre, can be used to identify the trend centre (Saunders et al, 2012). Frequency and percentage are widely employed in descriptive analysis to describe the target respondents' demographic traits. Regression analysis is used to determine the relationship between a dependent variable and one or more independent variables (Tabachnick and Fidell, 2007).

According to Saunders et al. (2012), regression analysis is used to solve the regression equation and predict the outcome of a dependent variable based on the value of one or more independent variables. That comment suggests that the researcher chose to utilise regression analysis because three independent variables needed to have their effects on the dependent variable examined.

3.7.1 Validity

Reserch validity is the degree to which a survey includes all the components required for measurement. The ability of an instrument to measure what it is intended to measure is known as validity. If a method measures what it is designed to measure and yields results that closely match actual values, then it can be considered legitimate. A high degree of validity is implied by study results with a high degree of confidence. When a study establishes a relationship between two variables, internal validity is established. By statistically demonstrating that a given set of survey

questions is associated to a particular analytical aspect or result, the internal validity of a survey questionnaire can be established.

3.7.2 Reliability

The term "reliability" describes how consistently a procedure measures something, regardless of whether employing an instrument to measure something more than once yields the same result. The degree to which a research approach produces repeatable and dependable results is known as research reliability. A measurement is considered reliable if it is repeated on the same item of measurement and produces the same findings.

The reliability was evaluated using the Cronbach's alpha formula. The Cronbach's Alpha statistic was used to judge if the test and scales were appropriate for the inquiry. It comprises of an alpha coefficient with a value between 0 and 1, in accordance with Cronbach's Alpha. Values of Cronbach's Alpha that are equal to or higher than 0.7 are considered acceptable. An acceptable Cronbach's Alpha value is one of 0.8 or higher, and an exceptional value is one of 0.9 or above. Cronbach's Alpha values below 0.6 and 0.5 are regarded as poor and insufficient, respectively.

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

Figure 3.2: Cronbach Alpha

3.7.3 Correlation

The correlation coefficient is used to measure how closely two variables are related to one another. In linear regression, Pearson correlation (r) is frequently employed. The likelihood of a correlation is used to assess a two-way linear association between two continuous variables. Correlation is measured using the correlation coefficient, a statistic that expresses the strength of the apparent linear relationship between the variables in question.. Both calculation and interpretation are simple.

The strength of a relationship between data can be ascertained using correlation coefficient calculations. The results of the formulas range from

- 1 indicates a strong positive relationship.
- -1 indicates a strong negative relationship.
- A result of zero indicates no relationship at all.

Table 3.2: Correlation Coefficient Formula

	Coefficient, *r*	
Strength of Association	Positive	Negative
Small	.1 to .3	-0.1 to -0.3
Medium	.3 to .5	-0.3 to -0.5
Large	.5 to 1.0	-0.5 to -1.0

Based on formula above, one can determine the degree of correlation between two variables using Pearson's correlation coefficient (r). The strength of the relationship between the independent variables (personalized learning support, time management, and voice command) and the dependent variable in this study was evaluated using Pearson's correlation coefficient (the efficiency of online learning). This will show whether the correlation is real or not. When the independent and dependent variables have negative Pearson's correlation coefficients, the score on the other variable drops as the independent variable rises. The relationship between the

independent and dependent variables is positive if the Pearson's correlation coefficient is positive. This implies that if one variable improves, the score of another will as well.

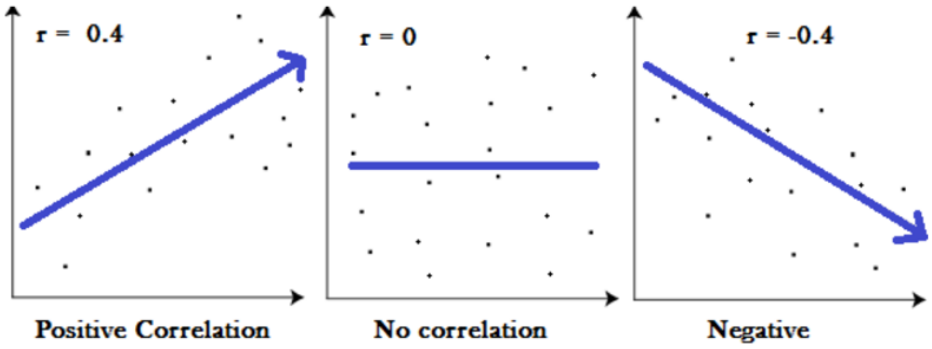

Figure 3.3: Correlation between -1, 0, and 1

3.7.4 Regression Analysis

A variable's value can be predicted using linear regression analysis based on the value of another variable. The dependent variable (the efficiency of online learning) is the variable that needs to be predicted. Personalized learning support, time management, and voice command are examples of independent variables that can use to predict the value of other variables.

3.7.4.1 R Square Value

R-squared measures the quality of fit of a linear regression model. This statistic shows the percentage of the variance of the dependent variable that can be explained by the independent variables taken together. R-squared measures the degree of correlation between the dependent variable and the model on a simple 0–100% scale. A model with a scale of 0% does not incorporate any variation in the response variable around its mean. The mean of the dependent variable predicts both the dependent variable and the regression model. A model with a scale of 100% takes into consideration all of the variation in the response variable around its mean.

R-squared is used to quantify the dispersion of data points surrounding a fitted regression line. The coefficient of determination is also known as the multiple coefficients of determination for multiple regression. For the same data set, a larger R-squared value denotes a smaller difference between the fitted and observed values.

$$R^2 = 1 - \frac{\text{sum squared regression (SSR)}}{\text{total sum of squares (SST)}},$$
$$= 1 - \frac{\sum(y_i - \hat{y}_i)^2}{\sum(y_i - \bar{y})^2}.$$

Figure 3.4: Formula R square regression

3.7.4.2 F Value

The regression between residual MS and MS was used to compute the F statistic. This statistic shows whether a regression model with the independent variable included fits the data more closely than a model without it. In essence, it evaluates the utility of the regression model.

Regression tests with the null hypothesis that all regression coefficients are equal to zero yield the F value. Put otherwise, the model lacks the ability to forecast. In essence, the f-test determines if adding a second coefficient will make a model better by comparing models that only include an intercept and a zero-predictor variable. Whatever coefficient is added to the model, if the researcher obtains a meaningful result, the model's fit has been enhanced.

3.7.4.3 T Value

The t-value is a numerical value calculated during statistical analysis. It represents the magnitude of the variation between two sample averages in relation to the data's variability. A greater difference between the groups under comparison is

suggested by a higher t-value. The ratio of the variation within the sample sets to the difference between the means of the two sample sets can also be used to describe the T-value.

When performing an unequal variance t-test, the following formula is used to get the t-value and degrees of freedom:

$$\text{T-value} = \frac{mean1 - mean2}{\sqrt{\left(\frac{var1}{n1} + \frac{var2}{n2}\right)}}$$

Figure 3.5: Formula T-value

On the other hand, the statistical hypothesis test known as the T-test is employed to ascertain whether the means of two groups differ significantly from one another. It makes use of the t-value in its computation. Depending on the nature of the data and the research issue, several t-test kinds (such as the independent samples t-test and the paired samples t-test) are used.

To use a t-test for the regression slope to determine significance. For this t-test, researchers employ the following null and alternative hypotheses:

- $\mathbf{H_0}$: $\beta_1 = 0$ (the slope is equal to zero)
- $\mathbf{H_A}$: $\beta_1 \neq 0$ (the slope is not equal to zero)

Then calculate the test statistic as follows:

- ***t* = *b* / SE*b***

where:

- ***b**:* coefficient estimate
- **SE*b***: standard error of the coefficient estimate

If the p-value that corresponds to *t* is less than some threshold (e.g., $\alpha = .05$) then reject the null hypothesis and conclude that there is a statistically significant relationship between the predictor variable and the response variable.

3.8 Summary

A research technique is, to put it simply, the actual "how" of any given piece of research. It mainly focuses on the methodical planning that a researcher must do before beginning a study to produce accurate and trustworthy results that address the goals and objectives of the study.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This chapter will examine the results and analysis of the survey questionnaire data that was distributed. The questionnaire was delivered to 384 respondents throughout Malacca and Johor. The researcher expounds on the numerous statistical tests and interpretations of the analysis results using SPSS version 27. The findings of this study are presented in the form of a table, graph, and chart to simplify and increase the efficacy of data interpretation.

4.2 Respondent Rate

Table 4.1: Rate of Responses Completed

	Number of Responses	Percentage
Total Responses Completed	384	100%

The total number of replies required is 384. The questionnaire was sent using Google Forms, and 384 responses were received. To guarantee that responders did not leave out any questions before submitting the Google Form, all the questions on the Google Form were marked as "*Required" to answer. Therefore, the questionnaire that was completely answered by respondents is 384 in total which 100% response rate. Based on all the data collected through Google Forms, the table below will show and summarize the rate of response.

4.3 Descriptive Statistics Analysis

4.3.1 Respondent Demographic

This section identifies the frequency of the basic features of respondent demographic analysis, the 354 respondent are measured demographically in terms of their gender, age, race, level of education, have a device for online learning, how many devices used for online learning, and what devices uses for online learning.

Table 4.2: Demographic Profile of Respondents

Variable	**Description**	**Number**	**Percentage (%)**
Gender	Male	147	41.5
	Female	207	58.5
Race	Malay	261	73.7
	Chinese	54	15.3
	Indian	36	10.2
	Black Negro	1	0.3
	Orang Asli	1	0.3
Age	15-24 years	286	80.8
	25-34 years	57	16.1
	35-44 years	7	2.0
	45-54 years	3	0.8
Level of Education	SPM	4	1.1
	STPM/Diploma/Foundation/ Matriculation	58	16.4
	Degree	256	72.3
	Master	26	7.3
	PHD	3	0.8
	Lecturer	5	1.4

	SKM	1	0.3
Do you have a device for online learning?	Yes	330	93.2
	No	3	0.8
	Maybe	21	5.9
How many devices do you use for online learning?	Only 1	56	15.8
	2 devices	247	69.8
	3 and more devices	50	14.1
What device do you use for online learning?	Laptop	210	59.3
	Desktop	21	5.9
	Tablet	54	15.3
	Smartphone	68	19.2

4.3.1.1 Gender

Table 4.3: Frequency Respondent Demographic of Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	207	58.5	58.5	58.5
	Male	147	41.5	41.5	100.0
	Total	354	100.0	100.0	

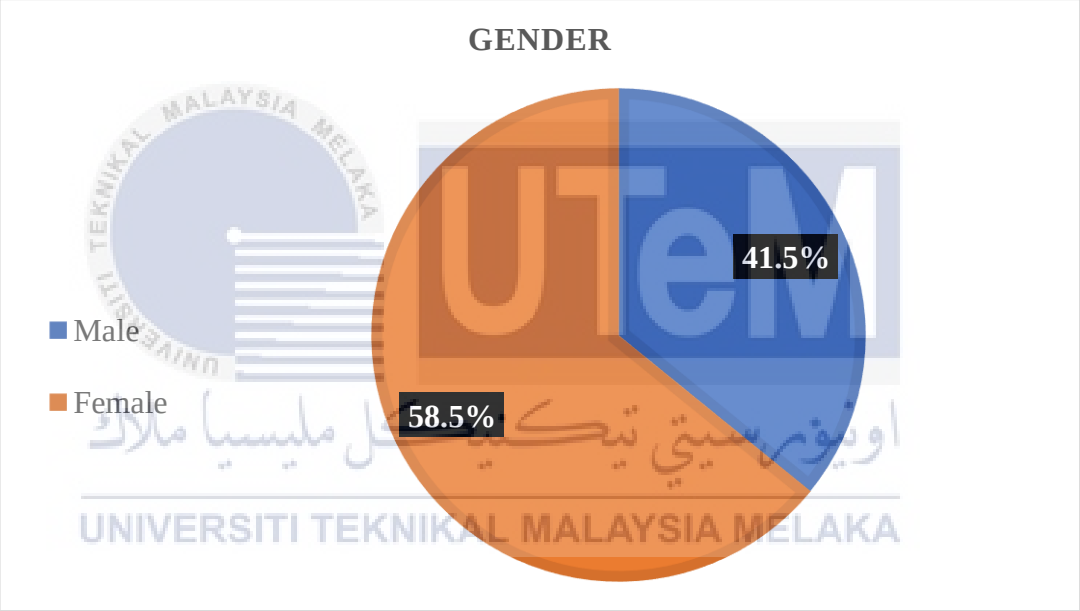

Figure 4.1: Pie Chart of Respondent Demographic of Gender

Gender analysis statistics based on Table 4.3 and Figure 4.1 reveal that 147 respondents were male and 207 were female out of 354 respondents who participated in this research. Male respondents made up 41.5% of the total, while female respondents made up 58.5%, indicating that female respondents took part in this survey more than male respondents.

4.3.1.2 Race

Table 4.4: Respondent Demographic of Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Black Negro	1	0.3	0.3	0.6
	Chinese	54	15.3	15.3	15.8
	Indian	36	10.2	10.2	26.0
	Malay	261	73.7	73.7	99.7
	Orang Asli	1	0.3	0.3	100.0
	Total	354	100.0	100.0	

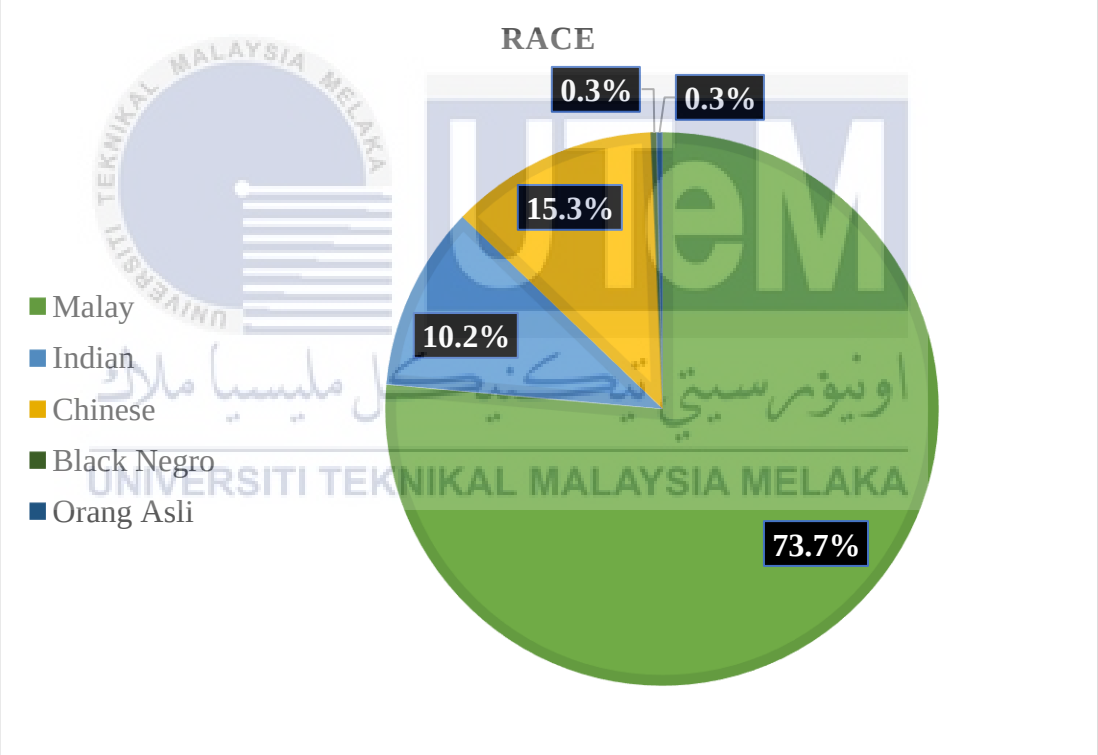

Figure 4.2: Pie Chart Respondent Demographic of Race

According to Table 4.4 and Figure 4.2 shows that the majority of respondents were Malay, with 261 (73.7%) out of 354 respondents being Malay, 54 (15.3%) being Chinese, 36 (10.2%) being Indian, 1 (0.3%) being Orang Asli and Black Negro.

4.3.1.3 Age

Table 4.5: Pie Chart of Respondents Demographic of Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-24 years	286	80.8	80.8	81.1
	25- 34 years	57	16.1	16.1	97.2
	35-44 years	7	2.0	2.0	99.2
	45-54 years	3	0.8	0.8	100.0
	Total	354	100.0	100.0	

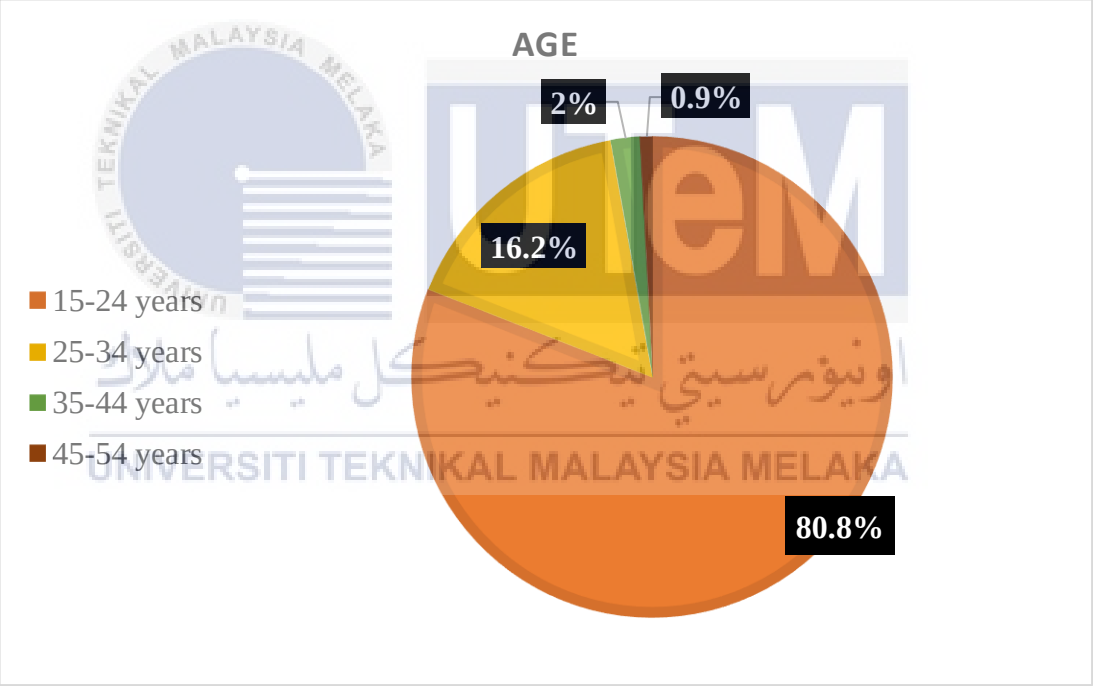

Figure 4.3: Pie Chart of Respondent Demographic of Age

According to Table 4.5 and Figure 4.3 above, most respondents for this study were between the ages of 15 to 24 years, representing 80.8%. This is followed by 57 respondents aged 25 to 34 years, who represent 16.1%, and 7 respondents aged 35 to 44 years, who represent 2.0%. Meanwhile, just 0.8% of the 3 respondents are 45-54 years old. It is possible to conclude that those aged 15-24 years old are more responsive to this questionnaire.

4.3.1.4 Level of Education

Table 4.6: Respondent Demographic of Level of Educations

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Degree	256	72.3	72.3	72.6
	Lecturer	5	1.4	1.4	72.0
	Master	26	7.3	7.3	81.4
	PHD	3	0.8	0.8	82.2
	SKM	1	0.3	0.3	82.5
	SPM	4	1.1	1.1	83.6
	STPM/Diploma/Foundation/ Matriculation	58	16.4	16.4	100.0
	Total	354	100.0	100.0	

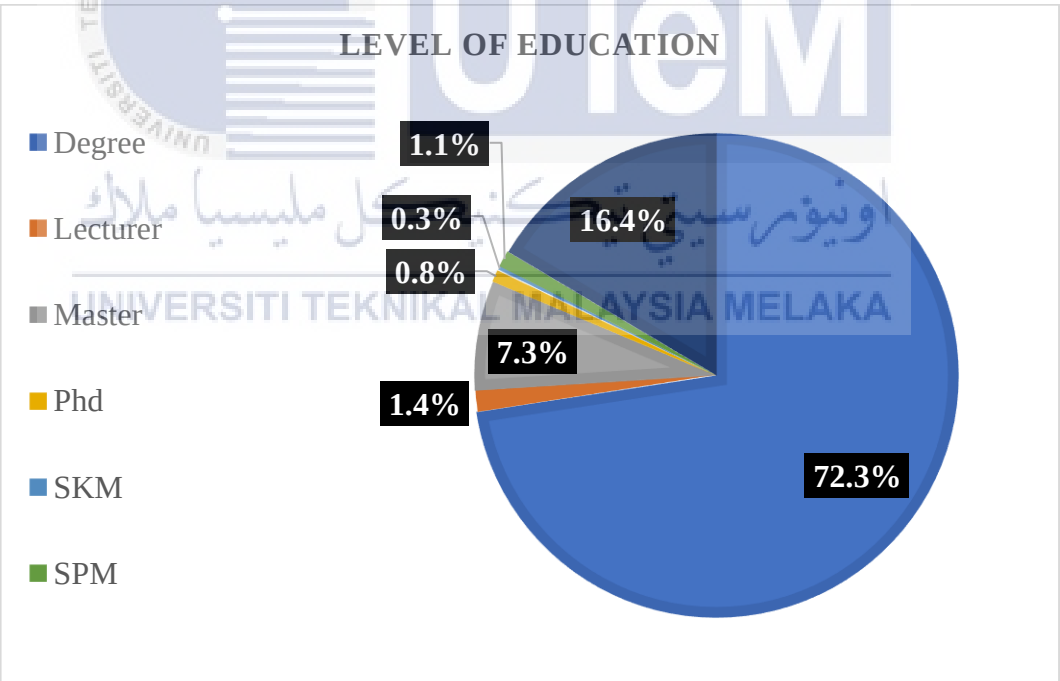

Figure 4.4: Pie Chart of Level of Education

According to Table 4.6 and Figure 4.4 above, most respondents (256 with a proportion of 72.3%) had a Degree level of education. Furthermore, there are 58 respondents with an STPM/Diploma/Foundation/Matriculation (16.4%), 26 respondents with a Master (7.3%), and 4 respondents with an SPM (1.1%). 5

respondents with a Lecturer (1.4%) and SKM education is the lowest among respondents, accounting for one respondent with 0.3%. This demonstrates that respondents with a degree background are simpler to approach and cooperate with in completing this questionnaire.

4.3.1.5 Do you have a Device for Online Learning

Table 4.7: Respondent Demographic of Have a Device for Online Learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	3	0.8	0.8	0.8
	Maybe	21	5.9	5.9	6.8
	Yes	330	93.2	93.2	100.0
	Total	354	100.0	100.0	

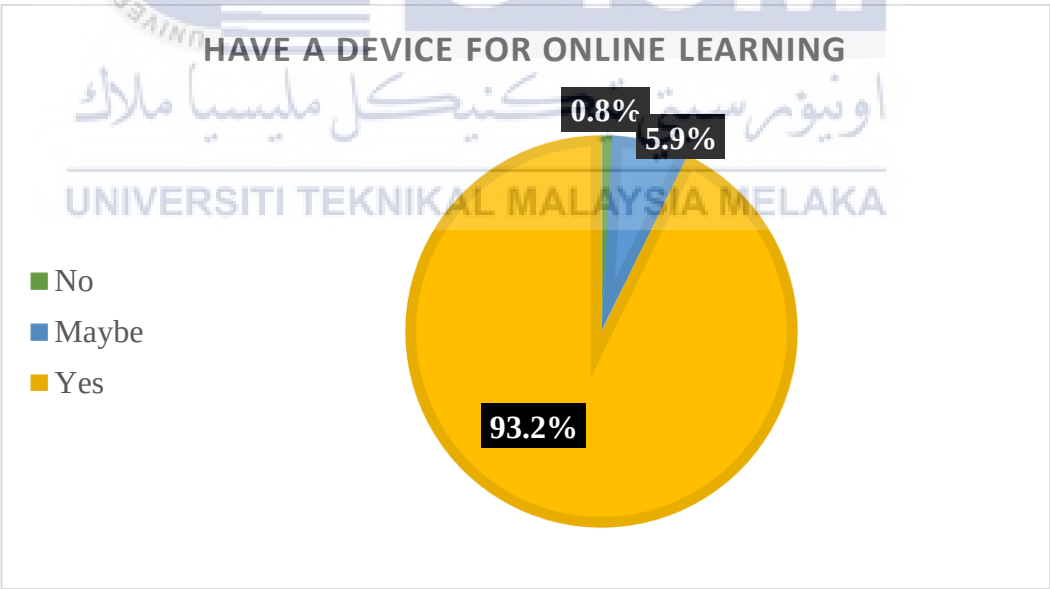

Figure 4.5: Pie Chart of Have a Device for Online Learning

The figure above depicts the respondents having a device for online learning. Respondents who have a device for online learning is 330 (93.2%), and the respondent maybe has a device for online learning is 21 (5.9%). While there are only

3 (0.8%) respondents did not have a device for online learning. This demonstrates that the respondents have a device for online learning.

4.3.1.6 How Many Devices Use for Online Learning

Table 4.8: Respondent Demographic of How Many Devices Use for Online Learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2 devices	247	69.8	69.8	70.1
	3 and more devices	50	14.1	14.1	84.2
	Only 1	56	15.8	15.8	100.0
	Total	354	100.0	100.0	

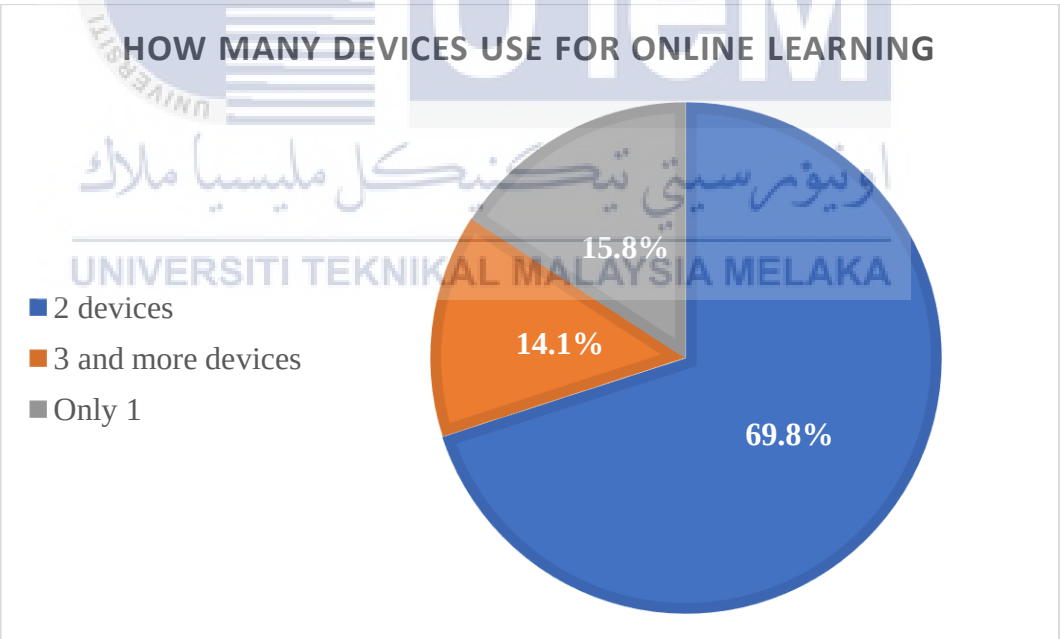

Figure 4.6: Pie Chart of How Many Devices Use for Online Learning

How many devices are used for online learning analysis statistics based on table 4.8 and figure 4.6 reveal that 247 (69.8%) respondents have 2 devices. While 56 (15.8%) respondents only have 1 device and 50 (14.1%) respondents out of 343

respondents that participated in this research have 3 and more devices for online learning.

4.3.1.7 What Device Use for Online Learning

Table 4.9: Respondent Demographic of Device Use for Online Learning

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Desktop	21	5.9	5.9	6.2
	Laptop	210	59.3	59.3	65.5
	Smartphone	68	19.2	19.2	84.7
	Tablet	54	15.3	15.3	100.0
	Total	354	100.0	100.0	

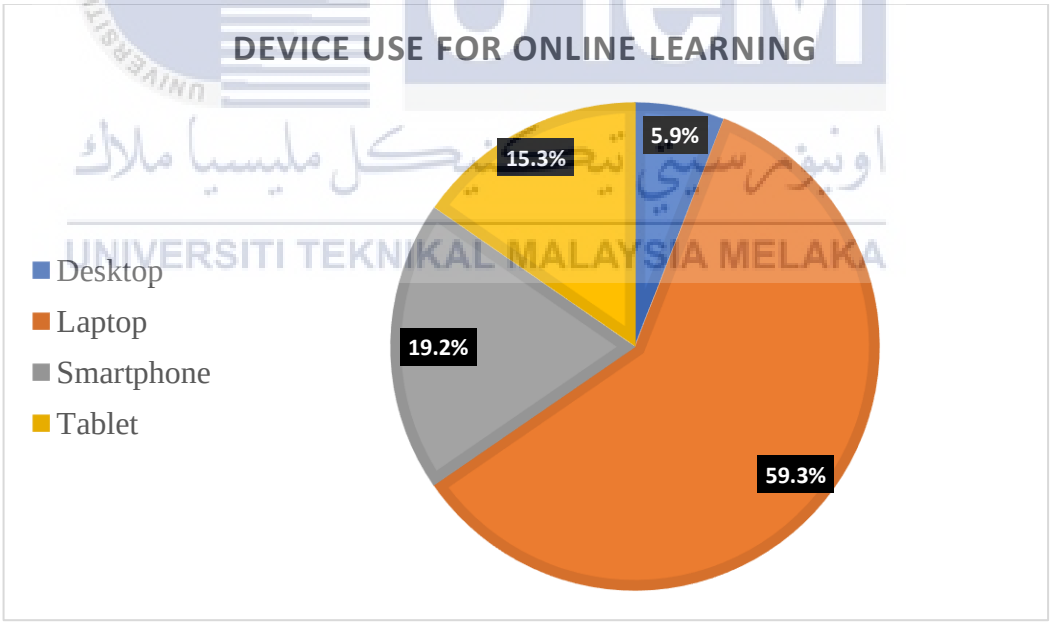

Figure 4.7: Pie Chart of Device Use for Online Learning

Based on Table 4.9 and Figure 4.7 above, show that the devices used for online learning mostly are laptops which is 210 from 354 respondents with a value of percentage is 5.9%. Secondly, respondents use smartphones are 19.2% which is 68 respondents. Thirdly, respondents use tablet are 15.3% which is 54 respondents. The

lowest number of respondents is 21 with 5.9% of devices used on desktops for online learning. In conclusion, mainly of the respondent who participated in this survey used laptops for their online learning.

4.3.2 Descriptive Statistics for All Variables

The descriptive statistic for variables analyses and interprets respondents' views of the variables in the conceptual framework. In this study, a 5-point Likert scale ranging from 1: Strongly disagree, 2: Disagree, 3: Somewhat, 4: Agree, and 5: Strongly agree was employed as an assessment. The table below provides the statistics for each variable as well as the proportion of respondents that completed the survey using a 5-point Likert scale.

4.3.2.1 Descriptive Statistics of Independent Variables 1 (IV 1)

Table 4.10: Statistics of Independent Variables 1 of Personalized Learning Support

Item Statistics	N	Mean	Std. Deviation
I can customize the online learning content.	354	3.42	0.785
I can also access the online learning resources easily.	354	3.87	0.650
I always receive appropriate online feedback in real-time.	354	3.68	0.622
I can monitor my progress online.	354	3.84	0.574
I can develop my learning skills.	354	3.89	0.657

Table 4.10 above indicates that all 354 sets of data received are valid and no data is missing. All the statements in this variable that is the sub-variable personalized learning support had mean values between 3.42 and 3.89, which is considered as high score according to respondent perception. The following above shows the percentage of the respondents' perception on the first independent variable that is personalized learning support toward the role of virtual assistant which have 5 different sub-variables. Firstly, student can customize the online learning content. Next, student can also access the online learning resources easily. Student also can always receive appropriate online feedback in real time. Others sub-variables is student can monitor their progress online and student can develop their learning skills.

4.3.2.2 Descriptive Statistics of Independent Variable 2 (IV 2)

Table 4.11: Statistics in Independent Variable 2 of Time Management

Item Statistics

	N	Mean	Std. Deviation
I can plan my online study.	354	3.74	0.695
I can manage my time based on the schedule.	354	3.84	0.669
I can get relevant online resources for my research.	354	3.88	0.679
I found that my online assessment has positive impact.	354	3.85	0.623
I can dedicate time for my online studying.	354	3.78	0.646

Table 4.11 above indicates all 354 sets of data received are valid and no data is missing. All the statements in this variable that is the sub-variable time management had mean values between 3.74 and 3.88, which is considered a high score according to respondent perception. The following above shows the percentage of the

respondents' perception on the second independent variable that is time management toward the role of virtual assistant which have 5 different sub-variables which are student can plan their online study, student can manage their time based on the schedule, and student can get relevant online resources for their research. Besides that, student also can find that their online assessment give positive impact and they also can dedicate time for their online studying.

4.3.2.3 Descriptive Statistics of Independent Variables 3 (IV 3)

Table 4.12: Statistics in Independent Variables 3 of Voice Command

Item Statistics

	N	Mean	Std. Deviation
I can engage with others effectively online.	354	3.83	0.611
I can communicate during online classes effectively.	354	3.75	0.627
I find it easier to use various online study tools.	354	3.64	0.648
I can do multitasking whenever necessary.	354	3.90	0.595

Table 4.12 above indicates all 354 sets of data received are valid and no data is missing. All the statements in this variable that is the sub-variable voice command had mean values between 3.64 and 3.90, which is considered a high score according to respondent perception. The following shows the percentage of the respondents' perception on the third independent variable that is voice command toward the role of virtual assistant which have 4 different sub-variables which student can engage with others effectively online, student can communicate during online classes effectively, student also can find easier to use various online study tools, and lastly student can do multitasking whenever necessary.

4.3.2.4 Descriptive Analysis of Dependent Variable (DV)

Table 4.13: Statistics in Dependent Variables of The Efficiency of Online Learning

Item Statistics

	N	Mean	Std. Deviation
Lecturers can evaluate student learning outcomes online.	354	3.79	0.766
Online learning helps students achieve better results.	354	3.67	0.748
Lecturers can track the percentages of students' assignments online.	354	3.95	0.585
Lecturers can measure the time students spend on online learning.	354	3.69	0.716
Lecturers can collect online course evaluations from students.	354	3.96	0.563

Table 4.13 above indicates all 354 set of data received are valid and data there are no data is missing. All the statements in this variable that is the sub-variable voice command had mean values between 3.67 and 3.96, which is considered a high score according to respondent perception. The following shows the percentage of the respondents' perception on the dependent variable that is the efficiency of online learning which have 5 different sub-variables which lecturers can evaluate student learning outcomes online, lecturers can track the percentage of students' assignments online, and lecturers can measure the time student spend on online learning. Besides that, lecturers also can collect online course evaluations from students and online learning helps students achieve better results.

4.3.3 Normality Test

A normality test is a statistical method used to determine if a given data set follows a normal distribution. Normality tests are employed to assess whether deviations from normality exist, which can impact the validity of certain statistical analyses. The skewness value has fall within the range of -3< skewness <3, and as for the kurtosis have a range -10< kurtosis < 10. Based on table 4.14 below, the highest skewness is -1.491 and the lowest skewness is -0.046. Meanwhile, the highest kurtosis is 4.406 and the lowest kurtosis value is -0.357. Then, it can be concluded the data was normally distributed.

Table 4.14: Normality Test

Variable	Mean	Std. Deviation	Skewness	Kurtosis
Personalized Learning Support				
1. PLS1	3.42	.785	-.362	-.357
2. PLS2	3.87	.650	-.878	2.342
3. PLS3	3.68	.622	-.422	.807
4. PLS4	3.84	.574	-.981	2.974
5. PLS5	3.89	.657	-1.066	2.848
Time Management				
1. TM1	3.74	.695	-.725	1.643
2. TM2	3.84	.669	-1.101	2.532
3. TM3	3.88	.679	-1.491	4.406
4. TM4	3.78	.646	-.731	2.260
5. TM5	3.85	.623	-.534	1.696
Voice Command				
1. VC1	3.90	.595	-.973	3.506
2. VC2	3.64	.648	-.046	.302
3. VC3	3.75	.627	-1.031	2.101
4. VC4	3.83	.611	-1.299	3.273

4.4 Reliability Test

In this part, Cronbach's Coefficient Alpha was used to calculate the reliability of all variables. Cronbach's alpha has a value larger than 0.70 to establish the dependability value. The acquired data for reliability test were analysed using the Statistical Package for Social Science (SPSS) version 27 software.

4.4.1 Pilot Test

In this study, the researcher used Cronbach's Alpha Coefficient in this survey to examine the reliability of four independent variables and one dependent variable, totalling 30 items from 30 respondents. A pilot test was carried out before distributing the research questionnaire to the intended respondents.

Reliability Statistics

Table 4.15: Reliability Statistics of 30 Respondents

Variable	Cronbach's Alpha	N of Items
IV 1	0.941	30
IV 2	0.955	
IV 3	0.935	
DV	0.932	

Case Processing Summary

Table 4.16: Listwise deletion based on all variables in the procedure

		N	%
Cases	Valid	30	100.0
	Excluded[a]	0	0.0
	Total	30	100.0

Based on the result of the reliability test on the pilot survey above, the Cronbach Alpha value for independent variable 1 which personalized learning support is 0.941. Also, the value for independent variable 2, time management is 0.955 and independent 3, voice command is 0.935. Then for the dependent variables which is the efficiency of online learning scored 0.932 which is considered an excellent reliability value. Since all the results of variables from Cronbach's Alpha value in this study scored above 0.70. Therefore, it can be concluded that the overall pilot test in reliability

test of all items in the questionnaires used is acceptable and valid which can lead to further study.

4.4.2 All Data

In this part, Cronbach's Coefficient Alpha was used to calculate the reliability of all variables from 354 respondents. Cronbach's alpha has a value larger than 0.70 to establish the dependability value.

Reliability Statistics

Table 4.17: Reliability Test for All Data

Variable	Cronbach's Alpha	N of Items
IV 1	0.895	354
IV 2	0.936	
IV 3	0.897	
DV	0.942	

Based on the table above, the result of the reliability test on the independent variable 1 showed, the Cronbach Alpha value for the personalized learning support scored 0.895 which is considered good reliability. Then, for the independent variable 2, the Cronbach Alpha value for the time management scored 0.936 which is considered excellent reliability. For the independent variable 3 which voice command, the Cronbach Alpha value for the voice command scored 0.897 which is considered excellent reliability. Lastly, the result of the reliability test on the dependent variable above showed, the Cronbach Alpha value for the voice command scored 0.942 which is considered excellent reliability. Since the results of the all variables are above 0.70, therefore it can be concluded that the overall reliability test of all items is significant and acceptable.

4.5 Pearson Correlation Analysis

In this section, the researcher would like to to measure how closely two variables are related to one another. The Pearson correlation coefficient, or r, will be closer to +1 or -1, depending on whether the relationship is positive or negative, based on how strongly the two variables are associated.

Table 4.18: Correlation Analysis of Independent Variables

		Personalized Learning Support	Time Management	Voice Command
Personalized learning support	Pearson Correlation	1	.758**	.658**
	Sig. (2-tailed)		<.001	<.001
	N	354	354	354
Time management	Pearson Correlation	.758**	1	.785**
	Sig. (2-tailed)	<.001		<.001
	N	354	354	354
Voice command	Pearson Correlation	.658**	.785**	1
	Sig. (2-tailed)	<.001	<.001	
	N	354	354	354

Based on the table above, there are significant relationships between all the variables as the significant output between the variables is 0.001. There was a strong, positive correlation between personalized learning support and time management, which was statistically significant (r = .758, n = 354, p = <.001). Then, there was a strong positive correlation between time management and voice command, which was statistically significant (r = .785, n = 354, p = <.001). Hence, A Pearson product-moment correlation was run to determine the relationship between voice command and personalized learning support. There was a moderately strong positive correlation between voice command and personalized learning support, which was statistically significant (r = .658, n = 354, p = <.001). The result presented the Pearson Correlation Coefficient in all variables are strong positive significant.

4.6 Regression Analysis

Regression analysis is a statistical technique used to examine the relationship between many independent variables and a single dependent variable. Researchers use it to forecast the value of a variable based on the values of three other variables. The researcher hopes to predict the independent and dependent variables. To predict the value of the dependent variable, the researcher will use independent variables. Personalized learning support, time management, voice command, and the efficiency of online learning. To test the theory, the researcher employed regression analysis. The model summary and coefficient sections make up the regression analysis's three sections.

4.6.1 Model Summary

Table 4.19: Regression Analysis (Model Summary)

Model	R	R Square	F Change	df1	df2	Sig
1	.750	.562	115.108	3	351	<.001

Based on the research analysis by Regression Analysis above, the correlation coefficient (r) value is 0.750 which indicates that the three independent variables (personalized learning support, time management, voice command) are highly correlated to the dependent variable (the efficiency of online learning). This means that the respondents are positive. Furthermore, the result of the coefficient of determination, R Square in this research shows that a total variation of $r^2 = 0.562$. So, this means that the remaining 56% of the variation are indirect factors which means other variables have been used for this study to affect the efficiency of online learning.

Then, the F-value is whether the overall regression model is a good fit for the data. The table shows that the independent variables statistically significantly predict the dependent variable, $F (3, 351) = 115.108$, $p < .001$.

4.6.2 Coefficients

Table 4.20: Regression Analysis (Coefficient)

		Unstandardized Coefficient			
Model		B	Std. Error	t	Sig.
1	(Constant)	.600	.174	3.437	<.001
	IV 1	.314	.067	4.653	<.001
	IV 2	.268	.081	3.302	<.001
	IV 3	.269	.068	3.940	<.001

Based on table 4.20 above, is indicated to determine the result of the coefficient between independent variables and dependent variables. For the independent variable of personalized learning support, time management, and voice command it is significant because of the value of p = 0.001 which is less than the p-value 0.05. Based on the data from the coefficient table, the following regression equation was developed for this study:

Equation (DV): 0.600 – 0.314 (IV1) + 0.268 (IV2) + 0.269 (IV3)

Unstandardized coefficients indicate how much the dependent variable varies with an independent variable when all other independent variables are held constant. The unstandardized coefficient, B Model 1, for personalized learning support is equal to 0.314. This means that for each one year increase personalized learning support, there is a increase in the efficiency of online learning of 0.314 ml/min/kg.

4.7 Hypothesis

In this part, a regression analysis was used to determine the test outcome and to investigate the effect of independent factors or variables. Regression analysis will be used to determine whether the findings are correct. If the T-value is greater than 1.96 and the relevant statistic is less than 0.05, the result can be accepted.

Table 4.21 Hypothesis of Research

Hypothesis	**T value**	**Results**
H1: There is a significant relationship between personalized learning support with the efficiency of online learning.	4.653	Supported/Accepted
H2: There is a significant relationship between time management with the efficiency of online learning.	3.302	Supported/Accepted
H3: There is a significant relationship between voice command with the efficiency of online learning.	3.940	Supported/Accepted

4.8 Summary

Finally, in this chapter, the researcher discussed the results obtained by using SPSS version 27. This section examined descriptive statistics, Pearson correlation analysis, reliability analysis, and multiple regression tests. The researcher discovered a relationship between the dependent variable and three independent variables after conducting the analysis. The researcher found all the theories to be acceptable.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

Based on the research, the results and suggestions were discussed. This chapter discusses the findings' conclusions, the implications of this research, and future research recommendations. Based on the findings, the study's recommendations for future research were suggested. In addition, the study questions and objectives will be addressed in this chapter.

5.2 Research Objective

In this study, three objectives must be met after the data from the questionnaire has been analysed, and almost 354 respondents participated in this survey to provide the findings for the researcher to meet the research objectives listed below:

5.2.1 Objective 1

The first objective of this research is to determine the relationship between the role of virtual assistants and the efficiency of online learning. After conducting the data analysis of Regression Analysis, the results were used to prove the objective. For this research, the role of virtual assistants was included in personalized learning support, time management, and voice command. Hence, the results showed that the role of virtual assistants has a significant relationship with the efficiency of online

learning as the R-Square analysed through regression analysis is 0.562 which the R-Square may be considered a moderate value to prove that there is a significant relationship.

In short, this can be supported by the items of demographic which there are 330 (93.2%) respondents have a device for online learning. So, there are no issues or problems that students cannot access the online classes. Then, by the items of variables, 60.4% of respondents agree that the students can plan their online study and 65.1% of respondents agree they can get relevant online resources for their research because they have their own devices. In addition, there are 75.3% of respondents agree that lecturers can track the percentages of students' assignments online. Monitoring completion rates can help identify any potential barriers or challenges that hinder learners' progress, improving the overall efficiency of the online learning process (Reich, 2019).

5.2.2 Objective 2

After figuring out the relationship between the role of virtual assistant with the efficiency of online learning, now address each of the virtual assistant variables. The variables involved are personalized learning support, time management, and voice command. According to the Pearson Correlation, the variables of personalized learning support, time management, and voice command can be concluded to have a moderate positive correlation toward each other variable because the r-value is greater than 0.5 which r-value for each variable is 0.758, 0.785, and 0.658. In short, based on Table 4.19, all variables have been correctly selected because greater than 0.7 with an r-value is 0.750 which respectively a strong positive significant relationship towards the efficiency of online learning.

This can be proved by the results of a demographic of the level of education. The result stated 256 (72.3%) respondents are at the level of Degree and 58 (16.4%) at the level STPM/Diploma/Foundation/Matriculation. There 247 (69.8%) respondents stated they have 2 devices they use for online learning. With the devices they have, the variables of time management can help the students dedicated time for

their online studying and 73% of respondents agree with that. In addition, 74.1% of respondents agree with the role of voice command which they can engage with others effectively online. Virtual assistants are trained to converse and interact with a person using speech, typing, and visual languages through natural language techniques (Villegas, 2021).

5.2.3 Objective 3

After figuring out each variable has been selected for the efficiency of online learning, the most important variables of virtual assistants are figured out as well from the three variables which are personalized learning support, time management, and voice command. According to Table 4.20 (page 68), the regression analysis of the coefficient for all three variables has a significant value. The results stated the unstandardized coefficient value of Beta of personalized learning support is 0.314. Then, the value of Beta for time management and voice command is 0.268 and 0.269. Among these 3 variables having a strong positive relationship with the efficiency of online learning, personalized learning support is the strongest as the Pearson Correlation scored the highest. The beta value of personalized learning support is also the highest compared to another two variables.

Then, by the items of variables, 68.2% of respondents agree that the students can access the online learning resources easily because they have their own devices. In addition, the role of personalized learning support can make students monitor their progress online easily and 72.4% of respondents agree with that. There are also have 46.5% of respondents agree that students can customize the online learning content. Personalized learning can be an efficient approach that can increase motivation, engagement, and understanding (Silva Oliveira, 2018). Learning is a personalized experience that helps one to broaden their knowledge, abilities, and viewpoint

5.3 Research Hypothesis

These hypotheses were created based on the suggested research framework to answer research questions and attain the research objectives.

5.3.1 Hypothesis 1

H0 : There is no significant relationship between personal learning support to the efficiency of online learning.

H1: There is a significant relationship between personal learning support to the efficiency of online learning.

According to Table 4.21 (page 69), it shown the relationship between personalized learning support and the efficiency of online learning. It can show the results of the hypothesis that personalized learning support was accepted and has a significant relationship with the efficiency of online learning. This is because based on Table 4.20, the regression results show that the T-value is 4.653 which is a value greater than 1.96 and had a significant value of 0.05. As a result, the researcher rejected the null hypothesis (H0) and accepted the alternative hypothesis (H1). The respondents agreed that personalized learning support gives the efficiency of their online learning.

It is supported by a questionnaire obtained by the researcher from the respondents. The results show that 60.7% agree that online learning helps students achieve better results. While 7.4% of respondents strongly agree with the question. Another 0.4% of respondents strongly disagree and 8.2 % disagree with online learning helps students achieve better results. This is because it may be hard to concentrate on coursework due too many distractions and also due to internet problem (Adnan, 2020). Also, a total of 72.4% and 70.4% of respondents are confident and agree that they can monitor their progress online and can develop their learning skills online. The ability to give learning resources according to each learner's individual needs, goals, abilities, and interests is one of e-learning's benefits (Chatti, 2010). Customized learning, or learning on demand, is a related study field that addresses a learner's requirements, goals, talents, and interests (Benson, 2001).

5.3.2 Hypothesis 2

H0 : There is no significant relationship between time management to the efficiency of online learning.

H1: There is a significant relationship between time management to the efficiency of online learning.

Table 4.21 (page 69), shows the relationship between time management and the efficiency of online learning. It can show the results of the hypothesis that time management has a significant relationship with the efficiency of online learning. This is because based on Table 4.20, the regression results show that the T-value is 3.302 which is a value greater than 1.96 and had a significant value of 0.05. As a result, the researcher rejected the null hypothesis (H0) and accepted the alternative hypothesis (H1). The respondents agreed that time management gives the efficiency of their online learning.

It can be look and supported by a questionnaire obtained by the researcher from the respondents. The results show that 52.3% agree that lecturers can measure the time students spend on online learning. While 34.7% of respondents somewhat agree and disagree with the question. Lecturers often track the time students spend in online classes through recorded attendance and also timestamps on submitted assignments or projects (Reiff, 2016). A total of 70.1% and 63% of respondents are confident and agree that they can manage their time based on the schedule and they found that their online assessment had positive impact. University students' primary time management responsibilities now extend beyond lectures and schedules to include more dynamic tasks including online learning, online group activities, and holiday planning. It is emphasized that time management is more important in the lives of students (Reyal, 2021).

5.3.3 Hypothesis 3

H0 : There is no significant relationship between voice command to the efficiency of online learning.

H1: There is a significant relationship between voice command to the efficiency of online learning.

Table 4.21 (page 69), shows the relationship between voice command and the efficiency of online learning. It can show the results of the hypothesis that voice command has a significant relationship with the efficiency of online learning. This is because based on Table 4.20, the regression results show that the T-value is 3.940 which is a value greater than 1.96 and had a significant value of 0.05. As a result, the researcher rejected the null hypothesis (H0) and accepted the alternative hypothesis (H1). The respondents agreed that voice command gives the efficiency of their online learning.

It is supported by a questionnaire obtained by the researcher from the respondents. The results show that 76.9% agree that lecturers can collect online course evaluations from students. Another 0.9% of respondents strongly disagree with that statement. A total of 68.7% and 72.1% of respondents are confident and agree that they can communicate during online classes effectively and they can do multitasking whenever necessary. Using an adaptive assistance tool, which was designed to help students to continue to participate in an online course and maintain engagement with their lecturers such as online training to utilize their self-regulatory skills (Beckman, 2022).

5.4 Contribution of Study

Research contribution refers to the importance or value added to existing knowledge in a particular field. The purpose of this research contribution is to contribute new information, insights or perspectives that may improve understanding, address gaps in knowledge, or have practical implications.

The results of this study can be interpreted in several different ways. For starters, virtual assistants contribute to government policy by increasing learning productivity in the classroom. Online education has a wide variety of modes that have grown rapidly around the world. This is due to the confluence of new technologies and the use of the internet on a global level as well as the increasing demand for a regularly trained workforce for the ever-growing digital economy.

Next, it also has an impact and contribution to organizations such as schools and institutions in Malaysia. As we know, online learning is increasingly used after the entire country was hit by the Covid-19 epidemic in 2020. Since then, all schools and institutions have been closed and students and instructors must attend online learning only. Until now, online learning is still carried out according to the situation and the needs of the institution. This can be seen when an institution starts using applications and virtual assistants that have various functions such as Microsoft Teams and Outlook. With the availability of various types of virtual assistants, it will facilitate teachers to obtain teaching materials as well as interest students in online learning with various virtual assistant platforms.

Finally, this study also contributes to the knowledge of researchers and readers. Various alternatives, tools and platforms that can be used to facilitate online learning. Not all students and teachers are literate about information technology (IT), where there are various technological facilities that can be used by them. With technology becoming more widespread and high-tech now, there are various virtual assistants and applications that can be used either for free or for a fee. In addition, virtual assistants allow students to improve their knowledge and skills in various fields by controlling the tools available in each virtual assistant. This can indirectly increase ICT-related knowledge, especially for the 40-year-old group who lack exposure to high technology.

5.5 Limitation of Research

While studying this study, the researcher has faced some specific constraints. Among the constraints faced is that it is difficult to obtain and collect data from respondents. Although the target respondents are among students, it is difficult to get them because there are a few students who just do nothing and ignore the survey questions, even though the researcher sends the form via WhatsApp and Telegram. This makes data collection more difficult to collect. Therefore, the researcher has made more efforts to continue to meet with the respondents face to face.

Researchers also face constraints such as researchers only using a quantitative approach to collect data through questionnaires. Here the researcher finds it difficult to get the opinion of the respondents about the research done such as the effect of the virtual assistant on them. Therefore, researchers only need to refer to journals or past studies for more in-depth information or perspectives.

5.6 Recommendations

The researcher has offered some recommendations for additional research in this section. Recommendations in a study article were important advice for the best course of action under conditions. Stated differently, this section can assist researchers in overcoming challenges and achieving a successful result. The implementation of practices, philosophies, studies, or policies is encouraged via recommendations.

The first recommendation is to do the research using both qualitative and quantitative methods. The primary suggestion is that to better comprehend the user perspective, future researchers should carry out qualitative investigations. By using this technique, the respondent may participate in greater numbers, giving the researcher access to a wider range of viewpoints from the respondent.

Finally, future researchers should consider including one or more learning methods (online learning versus physical learning) in their research. This is because the data is more valuable. After all, the researcher can compare it with other learning methods.

5.7 Summary

In this study, the researcher developed three research questions and objectives to understand the research topic and to explore the elements or role of virtual assistants in the efficiency of online learning. This study's respondents were Malaysian students and lecturers or teachers between the ages of 15 years old to 55 years old and above who learn and teach in online learning using virtual assistants. This study's geographical region is Malacca and Johor.

As a summary, the objective of the study was discussed. The results for the first objective where to determine the relationship of virtual assistants and online learning efficiency found that it is significant and has a relationship between them. The second objective result shows significantly where each virtual assistant variable has been correctly selected to determine the efficiency of online learning. The third objective result is significant and has confirmed that the most important variable of virtual assistants that affects online learning efficiency is personalized learning support.

In this chapter as well, the researcher has found that all hypotheses are significant. For the first hypothesis which is the relationship between personal learning support and online learning efficiency shows the highest t-value data, then, the hypothesis is significant and accepted. Furthermore, for the second hypothesis, the results show that it is significant and accepted, namely the relationship between time management and the efficiency of online learning. for the third hypothesis, it also shows a significant and accepted relationship between voice command and the efficiency of online learning.

Ultimately, the researcher has decided to focus this study on "the role of virtual assistants in the efficiency of online learning" for several reasons. Because of advancements in technology and the ongoing introduction and updating of new gadgets, systems, and technologies, the researcher decided to focus on virtual assistants as the subject of study. The Covid-19 pandemic and the rising number of people using online learning were further factors in the researcher's decision. Thus, using a virtual assistant can improve the effectiveness of their online education.

One of the novel aspects of the study of the role of virtual assistants in developing countries such as Malaysia is that it can fill a knowledge gap and advance knowledge of virtual assistants and the efficiency of online learning, as well as contribute to a better understanding of virtual assistants practices in developing

countries, particularly Malaysia. In conclusion, the survey gives a better knowledge of the role of virtual assistants in students' and teachers' perspectives on online learning.

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APPENDICES 1

QUESTIONNAIRE

FACULTY OF TECHNOLOGY MANAGEMENT AND TECHNOPRENEURSHIP

Questionnaire: The Role of Virtual Assistants in The Efficiency of Online Learning

Dear valued respondents,

My name is Nurin Iffa binti Iskandar, and I am final year undergraduate student from University Teknikal Malaysia Melaka (UTeM). As I mentioned before, I am currently conducting my final year project to **"The Role of Virtual Assistants in The Efficiency of Online Learning".**

There are **THREE (3)** section in this survey in this survey which is Section A, Section B, and Section C. Kindly answer ALL questions. Your response to each question in this questionnaire will only be analysed in aggregate forms. All information will be treated with strict confidentiality and shall only be used for the purpose of this academic research. The survey will take approximately 5-10 minutes. Your participation is very much appreciated.

Thank you in advance for your kind assistance.

NURIN IFFA BINTI ISKANDAR

Bachelor of Technology Management (Supply Chain and Logistics)

THE ROLE OF VIRTUAL ASSISTANT IN THE EFFICIENCY OF ONLINE LEARNING

QUESTIONNAIRE SECTION

SECTION A: RESPONDENT'S PROFILE

The following questions are intended to solicit information that will be used to determine the profile of respondent. Please (√) for the most suitable answers.

1. Gender

- Male
- Female

2. Race

- Malay
- Chinese
- Indian
- Others

3. Age

- 15 - 24 years old
- 25 - 34 years old
- 35 - 44 years old
- 45 – 54 years old
- 55 above

4. Level of Educations

- SPM
- STPM / MATRICULATION / DIPLOMA / FOUNDATION

- DEGREE
- MASTER
- PHD
- OTHERS

5. Do you have access to a device for learning online?

- Yes
- Maybe
- No

6. What device do you use for online learning?

- Laptop
- Desktop
- Tablet
- Smartphone

7. How many devices you use for study?

- Only 1
- 2 devices
- 3 and more devices

SECTION B: THE ROLE OF VIRTUAL ASSISTANT IN ONLINE LEARNING

Based on the questions below, please rate the questions briefly by using the 5 Likert scale that consists of:

1 - Strongly Disagree

2 - Disagree

3- Somewhat

4 - Agree

5 - Strongly Agree

*Please **RATE** or **TICK** the item using the following scale:

Strongly Disagree	Disagree	Somewhat	Agree	Strongly Agree
1	2	3	4	5

A. Personalized Learning Support

No	Items	1	2	3	4	5
1.	I can customize the online learning content.					
2.	I can also access the learning resources easily.					
3.	I always receive appropriate feedback in real-time.					
4.	I can monitor my progress.					
5.	I can develop the learning skills.					

B. Time Management

No	Items	1	2	3	4	5
1.	I can plan my study.					
2.	I can manage my schedule based on the timetable.					
3.	I can allocate dedicated time for studying.					
4.	I can get relevant resources for my research.					
5.	I found that my assessment had a positive impact.					

C. Voice Command

No	Items	1	2	3	4	5
1.	I can engage with others effectively.					
2.	I can communicate during online classes.					
3.	I find it easier to use various study tools.					
4.	I can be multitasking whenever necessary.					

SECTION C: THE EFFICIENCY OF ONLINE LEARNING

Based on the questions below, please rate the questions briefly by using the 5 Likert scale that consists of:

1 - Strongly Disagree

2 - Disagree

3- Somewhat

4 - Agree

5 - Strongly Agree

*Please **RATE** or **TICK** the item using the following scale:

Strongly Disagree	Disagree	Somewhat	Agree	Strongly Agree
1	2	3	4	5

No	Items	1	2	3	4	5
1.	Lecturers can evaluate student learning outcomes.					
2.	Online learning helps students achieve better results.					
3.	Lecturers can track the percentages of students' assignments.					
4.	Lecturers can measure the time students spend on online learning.					
5.	Lecturers can collect online course evaluations from students.					

APPENDICES 2

Gantt Chart 1

WEEK/ACTIVITIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Seminar Final Year Project 2														
Supervisor Confirmation From Coordinator														
First Meeting With Supervisor														
Title Discussion														
Title Confirmation														
Find References Materials such as Journals and Articles														
Submission Chapter 1														
Submission Chapter 2														
Submission Chapter 3														
Submission of Final Year Project 1														
Submission Video Presentation														
Proposal Defense														

Gantt Chart 2

WEEK/ACTIVITIES	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Research Framework and Research Question Corfimation														
Data Collection														
Data Analysis														
SPSS Training														
Submission Chapter 4														
Submission Chapter 5														
Submission Draft Final Thesis														
Correction Draft Final Thesis														
Submission Final Thesis														
Submission Video Presentation														
Final Year Project Viva 2														