UNIVERSITI TEKNOLOGI MARA

STUDENT ENGAGEMENT MODEL FOR COLLABORATIVE TECHNOLOGY IN ONLINE LEARNING

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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 26 November 2025 to conduct the final examination of Nur Zharif Sofea binti Khairul Anuar on her Masters of Science thesis entitled "Student Engagement Model for Collaborative Technology in Online Learning" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiner recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

Online learning is crucial in assisting teachers and students in their learning process anywhere and anytime. Previous research shows learning technology can improve students' learning. However, despite the widespread use of technology in education, many students still lack of engagement in online learning. Technology itself does not guarantee active participation as students may feel disconnected, passive, or unmotivated during online lessons. Therefore, this research highlights the opportunity to investigate the use of collaborative technology which can help to increase social presence for improving student engagement in online learning. Considering this point, this research aims to explore existing frameworks and models, to design student engagement model for collaborative technology usage in online learning and to validate student engagement model for collaborative technology usage in online learning. Initially, this research has reviewed existing frameworks and models that are related to student engagement and collaborative technology. Next, enhanced student engagement model is designed and validated by using multiple linear regression statistical analysis. This research has quantitatively conducted survey with 300 to 500 secondary school students as the respondents which aged between 13 to 15 years old with no record of disability. This research has discovered that collaborative technology and social presence as independent variables have significant relationship with student engagement as dependent variable. To elaborate, the model examining collaborative technology, social presence, and student engagement is not only theoretically related but also supported by the statistical analysis. The results also show that the model is accurate, reliable and capable of producing valid conclusions. Furthermore, the research findings contribute to the body of knowledge of collaborative technology for student engagement, hence, it may become as an alternative strategy to guide teachers in strengthening students' connectedness in online learning. As for the research limitation, it has addressed student engagement issues in online learning without focusing on any specific subjects and excluded students with disability. For future recommendations, this research can be extended to disabled students or for certain subjects which involves student engagement during online learning process.

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Abbreviations

MRSM	Maktab Rendah Sains MARA
SBP	Sekolah Berprestasi Tinggi
SE	Student Engagement
SPT	Social Presence Theory
TOL	Value of Tolerance
VIF	Variance Inflation Factor

CHAPTER 1
INTRODUCTION

1.1 Introduction

This chapter provides an overview of the research background. It begins with the background of the study to explain the context and importance of the topic. Then, it presents the problem statement, which identifies the main issue the research aims to address. The chapter also outlines the research questions and objectives that guide the research. In addition, it explains the scope and limitations, the significance of the study, and the ethical considerations followed during the research. Finally, it provides a brief outline of the thesis structure and a summary of the chapter.

1.2 Background of Study

Online learning refers to an environment where students receive information and knowledge virtually by using a system of learning with the use of an internet connection (Sifundza & Utete, 2023). There are also many terms used from previous literature that are equivalent to the meaning of online learning, which are distance learning, distance education, web-based learning, and e-learning (Hidayati, 2023). Performing online learning can be great with the utilization of collaborative technologies as a medium, as it provides a function to carry out collaborative work, such as collaborative learning activities in an educational environment (Oyarzun, 2023). Collaborative learning refers to the activity of gaining knowledge from teachers and peers in a group setting, from a distance, instead of performing it alone (Abuhassna et al., 2023). The author briefly defines collaborative learning as a situation in which two or more people work together on a task to achieve the same objective.

Living in the 21st century, online learning technology has become a necessity in our daily lives for all sectors, including education. The integration of technology into the education sector was adopted decades ago at all levels of education, including secondary schools in Malaysia. Education technology is evolving the nature of the teaching and learning landscape with the use of computer technology to enhance the

quality. Hence, it becomes one of the effective strategies to produce students who are skillful with technologies (Ghavifekr & Wong, 2022). Therefore, both teachers and students must have the skills to use technology to improve their digital competencies. Nowadays, the younger generation is more exposed to the use of technology, and it leads to a positive impact that seems as an advantage (Pinho & Gomes, 2024). Timotheou et al., (2023) stated that the integration of technology in education can have a positive impact as it can improve learning and contribute to an effective teaching and learning environment.

In Malaysia, the "pembestarian" effort began to make all schools digitalized by 2010 Dewi et al., (2023). Teachers were trained to use student-centered teaching to build a skilled future workforce, and the Ministry of Education worked with other organizations to support project-based and online learning. According to Ridhuan et al., (2023), The Malaysia Education Blueprint 2013-2025 established initiatives to enhance ICT usage, aiming to strengthen the role of technology in the education system.. It aims to improve student learning and interest through modern, technology-based teaching. To support this, the government provided internet access and e-learning platforms to 10,000 schools, including Vocational Colleges, using systems like IBestariNet and VLE Frog. Teachers receive training to use ICT effectively, and more computers are supplied with a target of one computer for every ten students. The government also promotes independent and distance learning and offers a wide range of online learning videos through EduWebTV.

Integrating technologies into education can facilitate the online learning process, and it is found to be beneficial in improving the quality of the session. As stated by Alenezi et al., (2023), using digital technology is more frequently associated with improving student learning outcomes and progress. Alenezi also agreed that the integration of technology into education can be advantageous, as it is able to motivate students in their learning progress. Meanwhile, Robillos (2023) mentioned that technologies used for teaching and learning sessions can give positive impacts in which can facilitate high student engagement that improves their confidence in learning and improves their performance as well. However, the use of online distance learning (ODL) in Malaysian institutions brought many challenges that caused students to feel

stressed and anxious, affecting their performance (Kamaludin & Sundarasen, 2023). Students struggled mainly because of heavy academic workloads, many assessments, and teaching methods that were not well-suited for online learning. Their stress increased when they received limited support from peers and instructors. Technology problems also added to their difficulties. Students mentioned that the switch to online learning happened abruptly, and the courses were not designed for online teaching or evaluation. The integration of technology in education not only provides the students with an opportunity to experience another method of learning, but the goal is to encourage and motivate the students to actively engage in the teaching and learning process (Rintaningrum, 2023). Therefore, there is a need to utilize education technology in online learning to improve student engagement.

Schnitzler et al., (2021) stated that student engagement leads to motivation in learning and influences their performance. Student engagement can be defined as a student-centered approach towards learning that is focused on students' connectedness, involvement, effort, energy, and time (Mohammad Hekmat et al., 2022). According to Maamin & Maat (2022), engagement means the effort towards learning and how they tend to master the knowledge. Plus, it is designed to help teachers understand and improve students' achievement of low-performing students. Student engagement can be related to different aspects, such as the quality of study, the learning outcomes, the reasons for dropout, and the effectiveness of teaching strategies (Oliveira et al., 2023). According to Kassab et al., (2023), student engagement can be a predictor of academic success, well-being, satisfaction, increased retention, decreased burnout, and enhanced self-directed learning. Kassab also stated that student engagement can be defined as students' psychological state, which means the feeling of being activated, making effort, and paying attention during learning activities and their connection with peers. Hence, it shows that student engagement plays a key role in students' academic success.

In association with student engagement with academic performance, social presence contributes to the development of self-regulation among students in online learning contexts (Zhong et al., 2022). Social presence is perceived to facilitate information sharing using collaborative technology, especially for online learning, since it is considered difficult to know exact feelings until they show interaction and positive

responses (Tain-Ming & Xu, 2021). Tain-Ming also mentioned that students have issues with user interactions based on their recent experiences in online learning. A study by Shehzad & Charles (2023) explores social presence in higher education and its impact on student engagement discovered that social presence and teacher-student interaction positively influence active learning through social engagement in the application of educational technology. Social presence is the feeling of being connected and "present" with others during communication (Alsayer et al., 2023). In online learning, it gives students a sense of being connected to their group. Hence, collaborative tools like video calls and sharing small personal details can strengthen this connection. A study by Yang & Phongsatha (2024) showed that online collaboration tools improved student interaction, emotional involvement, and sense of connection more than face-to-face group work. Online platforms provide features that traditional classrooms cannot easily offer, such as discussion forums, real-time collaboration, and sharing of multimedia. These tools allow students to interact more often and in more meaningful ways, giving and receiving feedback. Students can see how their ideas and their peers' ideas develop together and contribute to the project. This makes students feel included, connected, and more engaged in collaborative learning. Therefore, building strong social presence is essential for effective online collaboration, as it helps students feel connected and more engaged with others.

Social presence and the use of technology in education help students feel connected and engaged, promoting active and meaningful learning. The use of technology in education impacts the teaching and learning process, where the discussion of student engagement emerges, and the student must be actively involved in their learning. Student engagement requires three key elements, especially in technology-integrated education: a culture of connection between teachers and students, encouragement of asking questions, and active student involvement (Oliveira et al., 2023). Thus, there is an opportunity to investigate collaborative technology that can help increase social presence for improving student engagement. Although many studies have explored the use of collaborative technology in education, only a few have specifically examined how collaborative tools influence student engagement and learning quality through the lens of social presence. It is even more noticeable in the Malaysian context, where it remains limited. While several models and frameworks

related to student engagement and social presence have been developed, their application to collaborative technology in local educational settings has not been thoroughly explored. This gap highlights the need for conducting research that explores how collaborative technology can enhance student engagement and learning outcomes by promoting social presence in online or blended learning environments. Therefore, this research aims to address this gap by exploring existing frameworks and models to design a new student engagement model according to literature analysis, and validate the model through statistical analysis.

1.3 Problem Statement

Online learning is widely implemented in the education industry due to the rapid growth of technology integration, including collaborative technology for teaching and learning. Although these technologies provide flexible and interactive learning opportunities, it also brings challenges for both teachers and students. In previous literature, the challenge of online learning is to sustain student engagement, including their connectedness, involvement, and effort (Raj & Singh, 2023). As stated by Al-naabi & Cifuentes-faura (2023), the challenges that arose during online learning are student engagement, in which teachers need to find strategies to encourage students' interaction and motivation to sustain their engagement. Furthermore, the same issues mentioned by Kumar (2023) in online learning are to sustain student engagement. Next, a study by Khan & Jamil (2022) found that students' lack of motivation during the session also causes a lack of interest and lack of student interaction when conducting online learning. In another study, the issues of student engagement in online learning environments, such as students getting bored with the task given by teachers, and some of the students are not interested in joining online learning sessions (Johar et al., 2023; Susanti et al., 2024).

Furthermore, a study by Gumasing et al., (2022) mentioned that issues of student engagement are boredom and lack of satisfaction during online learning. Gumasing also mentioned that low-performance student has a higher level of boredom compared to high-performance students. Another research by Y. Wang (2024) stated that students become bored in online learning due to a lack of interest, lack of motivation, limited feedback, and involvement during online learning. Lack of engagement may lead to the feeling of disconnectedness with teachers and their peers during the session (Havik &

Westergard, 2020; Ebardo et al., 2021; Johar et al., 2023). In study by Ismail et al. (2024) found that Malaysian secondary school students often experience isolation, stress, and low motivation during online learning, all of which can hinder their engagement. Plus, several other challenges they face, such as unequal student access, differences in learning levels, and uncertainty about its effectiveness. Another study by AlSaqqaf et al., (2025) stated that in secondary schools, poor communication between students and teachers made online lessons difficult and forced changes in teaching methods. These challenges increased due to a shortage of resources and poorly planned technology systems.

Due to the challenges identified in previous research, particularly in online learning settings, several existing frameworks and models have been reviewed to understand how student engagement is explained in previous studies. However, the role of collaborative technology in sustaining student engagement is often not adequately addressed. Existing frameworks and models provide valuable insights into student engagement and collaborative learning. However, they generally do not address the integration of collaborative technology in online learning, which is essential for supporting interaction, communication, and participation in digital environments. This highlights the need for a framework that combines student engagement principles with collaborative technology to help students feel connected, included, and motivated in online learning.

Collaborative technology provides opportunities in the teaching and learning process as it can engage students within a collaborative environment (Demosthenous et al., 2020; Andrin et al., 2024). Existing collaborative technology helps in student active learning and improves student learning outcomes, and technology promotes learning comprehension and helps students in defining and overcoming the challenges and difficulties (Aliyu et al., 2022; Wagino et al., 2023). However, collaborative technology alone does not always achieve its full potential in enhancing the learning experience and student engagement. Nevertheless, integrating collaborative technology with the elements of social presence may help foster and strengthen student engagement (J. Salayo et al., 2021). High levels of student engagement led to positive affective emotions and attitude, such as maintaining their happiness and decreasing negative emotions like anger and boredom towards online learning, especially in supporting students' self-regulated learning and their interest towards learning (Bekker et al., 2023).

The findings indicate that the author discovered that emotional difficulties during the learning process may affect how well students perform academically. Many of the problems reported in the literature are associated with the application of collaborative technologies in an online learning context. Plus, most of the existing models reviewed by the author tend to emphasize non-technical aspects that impact student engagement. In order to address this gap, the current research integrates technological and social presence elements into a model for analysing student engagement in an online learning context. By exploring existing models for collaborative technology usage, this research is able to design and produce an enhanced student engagement model for collaborative technology usage with social presence elements for online learning context.

1.4 Research Questions

Research Question 1: What are the existing models that determine student engagement in using collaborative technology of online learning in Malaysia?

Research Question 2: What is a suitable model for measuring student engagement in using collaborative technology in online learning?

Research Question 3: How is the model validated for collaborative technology usage in online learning?

1.5 Research Objectives

Research Objective 1: To explore the existing models for collaborative technology usage of online learning in Malaysia context.

Research Objective 2: To design a student engagement model for collaborative technology with social presence theory in online learning.

Research Objective 3: To validate the student engagement model for collaborative technology usage in online learning using Multiple Linear Regression.

1.6 Scope and Limitations

This research aims to develop a new student engagement model that uses collaborative technology in the context of online learning. In Malaysia, schools are divided into two categories: 'Arus Perdana' (mainstream education) and 'Murid Berkeperluan Khas' (MBK), which refers to students with special needs. Firstly, this research explores how collaborative technology is used in an online learning context to improve student engagement, focusing only on 'Arus Perdana' secondary schools in Kelantan. Secondly, this research aims to enhance student engagement by applying existing collaborative technology. Meanwhile, this research is limited to students without disabilities, as including students with special needs may lead to different outcomes and could affect the findings. Additionally, this research does not focus on any specific school subject, as it examines overall learning experiences. Future research is recommended to explore how collaborative technology could support students with disabilities in their learning.

This research has several limitations. First, the study only focuses on secondary school students aged thirteen to fifteen years old. Students of different ages may have different levels of maturity, digital skills, and learning habits. Second, the sample is the mainstream students. Plus, this research did not include students from other school categories such as MRSM, SBP, technical schools, special education schools, or private schools. Third, since the sample is from Kelantan, the results cannot be generalised to all secondary school students in Malaysia. Students in other states may experience different engagement levels, challenges, and attitudes toward online learning. However, the findings can be generalized to the settings that have similar characteristics rather than to all populations. Fourth, this research focuses only on the Malaysian context, and Malaysia has its own policies, culture, and technological conditions. The results may not match the experiences of students in other countries.

1.7 Significance of The Study

The integration of technology in education has emerged throughout the year, where it has changed the nature of learning in the academic field. Besides, student engagement is important to indicate that online learning sessions are effective in students' performance towards academic achievement. The purpose of this research is

to explore, design, and validate a model for student engagement in an online learning context with the integration of collaborative technology and social presence elements. This research has explored many existing frameworks and models before constructing an enhanced student engagement model. This research contributes significantly to the body of knowledge by providing empirical analysis on student engagement in using collaborative technology with social presence elements as an enhanced model from the origin. It provides an alternative strategy and new insights into the online learning environment in the education sector. Through the model implementation, it helps scholars and practitioners in making a strategy to conduct an effective online learning experience.

The results and findings of this research have important practical implications for academic sectors that aim to optimize the use of technology in improving teaching and learning activities. Grasping the chance of evolving technology with the comprehension of theoretical concepts can be an alternative strategy to conduct online learning activities to sustain student engagement throughout the session. These insights can also assist in practicing new techniques for effective teaching and learning sessions. Plus, this research has addressed the existing gaps by providing an analysis of how student engagement can be improved using collaborative technology with the elements of social presence. Future researchers can explore more on this subject or under different conditions. This research highlights the broader societal implications of improving student engagement in an online learning environment, which helps in student academic achievement. By demonstrating the suggested model, this research can influence a new strategy towards a more effective way of online learning and increase the number of high-performance students.

Moreover, this research is significant to several groups, including teachers, students, and student community, and future researchers. As for the teachers, the results of this research serve as a method to help teachers sustain student engagement through the use of collaborative technologies. For the students, this research benefits students by enhancing their enjoyment in using technology, which in turn motivates them to improve throughout the learning process. Lastly, for the student community and future researchers, this research is significant in deepening the student community's understanding of collaborative technologies in an online learning context. Additionally, it contributes to expanding teachers' knowledge on how to effectively use these technologies. Understanding the impact of student engagement in online learning is

essential for developing a new effective strategy for the online learning environment. This research provides valuable insights that can guide academic sectors in optimizing technology for online learning. Future research is suggested to explore more regarding student engagement and collaborative technology to provide a comprehensive understanding of its benefits. Additionally, this research can contribute to the Information Technology (IT) industry, whereby IT developers can use the student engagement model as a reference to improve their knowledge in developing learning tools, hence, it can create more suitable and responsive to students' needs in digital learning environments. This research also extends the body of knowledge in education technology by filling a gap in existing models.

This study is important because it supports Malaysia's plans for digital education, such as the Malaysia Digital Education Policy (2023-2030) and the Malaysia Education Blueprint (2013-2025). These plans focus on improving students' digital skills, using more technology in teaching, and helping schools run online and blended learning well. By looking at how students take part in online learning and how teachers use gamification, this study gives useful information about what students need and what problems teachers face. The results can help the government and schools decide how to improve internet access, teacher training, and the use of digital tools in the classroom. This will help Malaysia achieve its goals of preparing students to be confident and skilled in the digital world.

1.8 Ethical Committee

After submitting the research proposal to the Research Ethics Committee (REC), the Committee approved the proposal for conducting this research at secondary schools in Kelantan in selected areas, which are Gua Musang, Kota Bharu, Machang, Jeli, Tanah Merah, Bachok, and Pasir Puteh.

1.9 Thesis Outline

This research includes several chapters with sub-sections under every chapter according to the thesis content of standard requirements, as shown below:

Introduction: Background Information, Research Problems and Research Questions, Research Objectives, and Significance and Motivation of Research

Literature Review: Overview of relevant literature, key theories and concepts, gaps in the literature, and Theoretical Framework

Methodology: Research Design, Data Collection methods, Sampling techniques, dan Data Analysis procedures.

Results and Analysis: Presentation of Findings, Data Analysis and Interpretation, discussion of results in relation to research questions

Discussion: Summary of key findings, contribution to the field, and recommendations for future research

References: Citations of all sources used in thesis

1.10 Chapter Summary

In summary, the author acknowledged that student engagement has become a key focus in online education due to its strong connection to learning outcomes and academic performance. Past literature is actively addressing the challenges of student engagement in an online learning context and its strategy to effectively engage students in their learning experience with the objectives of ensuring their success in academic achievement. Therefore, maintaining student engagement in an online environment is important, and this research explores various activities and strategies suggested by previous researchers to transform the learning process into an interactive and effective environment that promotes academic success. The literature analysis activities are outlined in the next chapter.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter reviews key concepts and theories related to the research, including online learning, student engagement, collaborative learning, social presence theory, and collaborative technologies. It also presents a critical review of previous studies that have examined the use of collaborative technology in educational settings. Additionally, this chapter addresses the problems and challenges identified in previous research. The purpose of this chapter is to support the research with relevant background knowledge to identify possible solutions to the existing gaps in the literature and to guide the reconstruction of the student engagement model to better fit the online learning context by utilising collaborative technology.

2.2 Overview of Online Learning

Nowadays, most educational institutions have adopted technological methods in schools, and online learning is not a new teaching practice. Previously, online learning was considered informal education, but now it has become a pedagogical transition and can gradually replace the formal education system in the case of emergency circumstances (Danchikov et al., 2021). As online learning is introduced, teachers may provide learning materials, contribute learning tasks, communicate with students, and monitor their activities during learning sessions from a distance, as it can be done anytime and anywhere (Hoerudin et al., 2023). Hoerudin also mentioned that the use of technology in education is an effort and way of thinking about using information, skills, and experience to solve learning problems, meet learning objectives, and improve abilities in using technology. According to Garlinska et al., (2023), the use of technology for online learning can assist teaching and learning sessions as it enhances the learning experience, and it is easier for teachers and students to communicate with each other and collaborate with their peers to complete their learning tasks. Plus, technologies for online learning provide new opportunities for learning, engagement,

and assessment, which help to improve student performance and make the online learning experience more effective.

As mentioned, online learning is not a new development in the education field, and it is found to be advantageous in the learning experience. According to Castro and Tumibay (2021), online education offers benefits, and some of them are the effectiveness in educating students, as a professional development, cost-effectiveness, and the possibility of providing world-class education. According to Fenteng (2023), the benefits of online learning include its flexibility and ability for the students to personalize their educational journey or also known as student-centered learning. Fenteng also describes that the availability of a wide range of learning materials, such as interactive simulations, has positively impacted student engagement and helps in a better understanding of their learning matters. A study by Zavodna et al., (2023) found that online learning is beneficial for educational purposes as it offers flexibility, time saving, improves digital skills, provides a wide range of learning resources, is self-centered, and encourages motivation in students. A study by Vimbi (2024) examined the advantages of online learning shows that online learning can lead to better achievement in academic, an increase in student engagement, help to improve digital literacy, and instant access to study materials.

Fundamentally, online learning is related to online engagements, and the goal is to reach students to sustain their participation for them to become responsible members in the online classroom (Saavedra, 2020; Salayo et al., 2021; Huang & Wang, 2023). As stated by Bedi (2023), when students are engaged in the learning process, they tend to perform better in their learning outcomes, where they are more likely to maintain their desire to learn, and they are less likely to feel isolated. In contrast, students who are disengaged and have a lack of interest towards learning and commonly associated with poor learning outcomes. Moreover, Lasekan et al., (2024) mentioned that student engagement is a crucial aspect in online education as it involves students' active participation, where the students are willing to put effort towards their education. Therefore, student engagement positively affects their achievement and learning experiences. Online learning engagement can have an impact on the learning process, especially to support students' self-regulated learning, flexibility, accessibility, and

their learning interest (Salayo et al., 2021; Mou, 2023). The recent growth of online learning has brought changes into the learning environment for teachers and students, as it allows them to choose which methods are the best to implement according to its flexibility and offers more control over learning courses (Jin et al., 2023).

Many studies shows that the integration of collaborative technology in education can support and improve the online learning process. Collaborative technology not only promotes active participation among students but also encourages teamwork and collaboration toward achieving shared learning goals. In addition, collaborative technology creates new opportunities for students to develop important skills such as communication, critical thinking, and digital literacy, which are essential in today's learning environment. In general, online learning offers several benefits to the education sector. One of the key advantages is its ability to support student-centered learning, where students take more responsibility for their learning progress. This approach has been linked to improved academic performance and better learning outcomes. However, despite these positive aspects, student engagement remains a major challenge in online learning environments. Many students struggle to stay motivated, focused, and actively involved in online classrooms. These engagement issues can negatively affect their academic achievements and learning experiences. Therefore, it is important to explore and address the factors that influence student engagement in online learning to ensure that students remain committed and successful throughout their educational journey. Student engagement remains a concern across the different types of online learning environments, and each type can affect how students stay engaged in different ways.

2.3 Online Learning Environment

The advancements in educational technology and platforms have supported the expansion of online learning practices. Online learning can take place in different environments, and each offers unique approaches to content delivery and student engagement. There are three different environments of online learning, which are synchronous, asynchronous, and hybrid (Amiti, 2020; Guerrero et al., 2023). Another researcher also stated that there are three different methods of performing online learning, namely synchronous, asynchronous, and blended learning (Susanthi, 2021;

Varkey et al., 2023). Next, Hotara et al., (2023) define synchronous method as a real-time learning process that involves direct interaction between teachers and students by using whichever platform or tools that are suitable to use for synchronous learning as instant chat, sharing application, audio, and video conferencing. Meanwhile, an asynchronous method is opposite to the synchronous method in which the involvement of teachers and students is not simultaneous, plus it does not require instant response or feedback. Besides, Hotara stated that an asynchronous learning process can be performed by using platforms such as project management platforms, messaging applications, document sharing platforms, or e-mail. Aside from that, the third online learning environment, namely hybrid learning, or also called blended learning, is the implementation of both synchronous and face-to-face learning partially (Rosenberg-Kima, 2024).

All the online learning environments, either synchronous, asynchronous, or hybrid, demonstrated positive effects on academic performance and provided different opportunities according to pedagogical method and depending on educational needs (Kaiser et al., 2023). MacNeill et al., (2024) pointed out that in terms of engagement, synchronous methods enable student interaction with teachers and peers with real-time feedback that will boost engagement during online learning. Meanwhile, an asynchronous method is structured in a way that student engage in the learning course at their own time and schedule. MacNeill also highlighted that implementing online learning in education gives the chance for teachers to rethink the way online education is provided in a way to maximize student engagement and improve learning outcomes. Successful online learning depends not only on having collaborative technology but also on the skills and readiness of teachers. Lack of training, pedagogical design, and experience in online learning may lead to a contradiction to the actual needs in delivering the courses that will make them feel disconnected with students and ineffective learning sessions for any of the online learning environments (Macneill et al., 2024; Ndibalema, 2022; Pandya & Patterson, 2021). Besides, understanding online learning environments is important for designing effective online education strategies.

2.3.1 Hybrid Online Learning

One of the online learning environments mentioned earlier is hybrid learning or also called blended learning, which refers to the combination of synchronous and face-

to-face methods according to contemporary needs (Amiti, 2020; Susanthi, 2021; Pai et al., 2023). Hybrid methods offer student-centered learning, and students are more active and independent in their learning. In addition, another way of performing hybrid learning is a virtual meeting between teachers and students when they are in different places, but can give each other feedback and interact with each other and sometimes, when the teachers and students can meet physically, they can also give responses to each other towards the learning activities (I. N. Pai et al., 2023). Next, hybrid or blended learning or also called Hybrid Flexible (HyFlex), is to give availability to change from synchronous method to asynchronous at any time necessary (Cahyani et al., 2021; Aksak Kömür et al., 2023). Aksak Kömür also stated that hybrid learning can be used as a new practice for alternative learning, and this method is suitable for all educational institutions. Moreover, hybrid learning offers flexibility and enables student-centered learning that can increase student engagement and learning satisfaction.

Blended learning encourages students to be more involved in their learning by combining online and face-to-face learning activities, which helps keep them motivated and engaged. A study by Ahmed et al., (2025) mentioned that implementing a blended learning approach makes students more engaged in their learning experience. Furthermore, Ahmad also discovered that blended learning has great potential in increasing student engagement. As highlighted earlier, students have the option to participate in learning synchronously or to access content online and interact with their teacher in person at a later time. The study by Ahmad shows that students who are involved in synchronous learning have a high level of engagement because they can interact with their teachers and peers directly, which creates a social learning experience. Besides, the real-time interaction and engaging sessions can be experienced by using blended learning methods, and it is demonstrated that the methods are enjoyable. The flexibility of collaborative technology usage in education has made it easier for both students and teachers to perform online learning either synchronously or asynchronously (Nieuwoudt, 2020; De Bruijn-Smolders & Prinsen, 2024).

Despite the advantages of hybrid learning, some limitations still exist. There are also the disadvantages of hybrid mode, which are procrastination, loss of discipline, problem keeping attention, insufficiently explained materials, and lack of motivation (Zavodna et al., 2023). Procrastination means that when the time given is flexible, students tend to delay their time to complete the learning task (Yaguchi & Ono, 2024). Students might lose discipline to do the task since there is no motivation in this type of

online learning. A related example of a situation includes when teachers upload the learning materials, which may provide insufficient information regarding the notes or task given. When the students need to study by themselves, they tend to lose motivation to continue doing what they need to do. Next, another disadvantage of hybrid learning is stated by Bursa (2023) is having problems in accessing the technology, loss of motivation, feeling lonely and unhappy, and negligence. Sometimes, some students have problems connecting with the technology due to technical issues, and some of them cannot afford to own a technology device. Students will also lose their motivation when any problems occur. They will also feel lonely and unhappy because they need to do the task alone, and that can cause a feeling of isolation and lead to low engagement.

It can be concluded that hybrid learning is an instructional approach that combines online and face-to-face teaching to support flexible and effective learning. It can increase student engagement by allowing learners to participate in various ways and at their own pace. The use of collaborative technology in this environment further supports active participation, group interaction, and peer learning, which are important elements for improving engagement. However, some challenges still exist, such as limited access to digital tools, low motivation, and feelings of isolation. To make hybrid learning more successful, teachers should plan lessons properly, integrate appropriate collaborative technologies, and provide consistent support to help students stay involved and connected throughout the learning process.

2.3.2 Synchronous Online Learning

After discussing hybrid learning, this research proceeds to discuss synchronous learning, which represents another significant method in online learning. The second method of online learning environment, specifically synchronous mode, is the teaching and learning activities that are delivered by teachers in a real-time or in the same time where the students actively participate in the session that promotes collaborative learning (Baxter & Hainey, 2023). According to Mao et al., (2023), an example of synchronous mode is that students can attend synchronous live virtual classes anywhere as long as they have an internet connection in which is usually held with the utilization of web conferencing platforms such as Blackboard or any other available learning management system (LMS). Besides, Mao mentioned that students can directly interact and communicate with their peers and teachers. Synchronous learning makes the

process more interesting and attractive since it brings a lot of benefits like emphasizing interpersonal skills, teaching presence, social presence, cognitive presence, immediate feedback from teachers, motivating students, self-regulation, and collaboration between peers.

Furthermore, synchronous learning is found to be beneficial for student engagement since it is a live meeting and engaging session (Susanthi, 2021; Van Der Stap et al., 2024). As mentioned by Zhang et al., (2023), synchronous learning allows students to actively participate in real-time discussion and encourages the elements of social presence as it impacts students' ability to engage during the session. In addition, Zhang also stated that synchronous learning offers students the opportunity to engage in online learning and tends to have positive learning outcomes. Synchronous learning approach provides benefits to the teachers with the chance to support students in developing self-regulatory behaviors (Hung et al., 2024). Furthermore, synchronous methods enable real-time interaction, which is closely linked to students' satisfaction and learning outcomes. Additionally, synchronous environments can be more engaging than traditional classrooms because, unlike traditional settings where teachers may not receive feedback from all students, synchronous methods allow students to respond immediately through instant chat (Olha, 2021; Hung et al., 2024).

Meanwhile, besides the advantages of the synchronous learning approach, there are also disadvantages in practicing the method. Susanthi (2021) stated in her study that the feedback of synchronous learning was not practical, as some students potentially left the online discussion and got lost in learning. Besides, Susanthi highlights that it becomes worse when students or teachers do not have an internet connection in order tojoin the online discussion because it may affect the live learning experience and cause some students to miss important information. Next, Siregar et al., (2023) mentioned that one of the disadvantages of synchronous learning is that having numerous students from various locations can create problems because synchronizing activities across different places is often difficult. Plus, synchronous learning requires students to do the learning task at the same time, and it may cause problems in communicating with each other. It needs an early planning schedule and negotiations in advance in order to ensure all participants are involved. Another disadvantage of synchronous mode mentioned by Indriyani et al., (2024) is that some of the students or teachers may have technical issues and which tends to cause difficulties associated with synchronous discussions. Indriyani also stated that the inadequacy of skills and support in using technology to conduct

synchronous learning may lead to several challenges, such as a lack of motivation and self-efficacy.

It can be concluded that synchronous learning is an important and widely used method in online education that offers many benefits, such as real-time interaction, immediate feedback, and enhanced student engagement through social presence and collaboration. It allows students to actively participate in live sessions and supports the development of self-regulation skills. These features make synchronous learning more dynamic and engaging compared to traditional classrooms. However, despite its advantages, synchronous learning also presents several challenges. Issues such as internet connectivity problems, difficulties in coordinating students across different locations, technical challenges, and a lack of skills or support can hinder the learning experience. These disadvantages highlight the need for careful planning, adequate training, and technological support to maximize the effectiveness of synchronous learning environments. Overall, while synchronous learning holds great potential for improving student engagement and learning outcomes, addressing its challenges is essential for its successful implementation

2.3.3 Asynchronous Online Learning

After reviewing the synchronous learning method, the discussion now moves to the next online learning environment, asynchronous learning. The third online learning environment, namely asynchronous mode, helps students to complete their learning activities. As mentioned before, asynchronous learning is when teachers and students communicate regarding learning tasks like accessing information and learning material at different times, so that both teachers and students can be more flexible in their time management. Plus, asynchronous mode is easier for students in their learning tasks since they have more time to complete the task, and asynchronous mode is considered more effective than synchronous mode (Siregar et al., 2023). Siregar also stated that the advantages of asynchronous learning are that it gives students the freedom for student to choose the right time to do their assignments. Furthermore, other advantages such as flexibility when using asynchronous mode, students can access learning materials anytime, student do not have to worry about competing with other students because they are learning in their own pace, and students can use the benefits of internet connection to find the needed answer for the learning task given (D. Li, 2022). Besides, students

can still communicate with their teachers verbally or via text messages in the chat box. Overall, the flexible nature of online learning makes it more convenient and engaging for students.

Undeniably, asynchronous mode also has to deal with its disadvantages. Typically, the collaborative tools that are usually used to implement asynchronous learning are email, discussion forums, and video recording. The disadvantages of asynchronous mode are that it requires more responsibility and discipline from students because learning asynchronously could be exhausting for the students, since it requires high concentration (Alfares, 2024). Alfares also agreed that there are potential difficulties with the problem of digital competency, plus it also needs consistent concentration from the student to focus on their learning task. Another disadvantage discovered by Akpomi (2023) is a lack of live interaction among students and no immediate feedback from teachers or other participants. In addition, asynchronous learning requires self-discipline, a lack of simultaneous interactions, and low motivation to learn. Akpomi said that dependent students would not be able to perform in this type of learning mode. Besides, it will increase the dropout rate among students.

It can be stated that asynchronous learning offers a flexible and student-centered approach that allows learners to manage their own time, complete tasks at their own pace, and access learning materials whenever needed. These advantages make asynchronous learning effective for supporting independent learning and accommodating diverse student needs. However, this learning mode also presents several challenges, including the need for strong self-discipline, consistent focus, and digital skills. The lack of real-time interaction and immediate feedback may lead to reduced motivation, feelings of isolation, and a higher risk of student disengagement or dropout. Therefore, while asynchronous learning can enhance flexibility and accessibility in online education, careful support and proper instructional design are necessary to help students stay engaged and succeed in this environment.

The summary of the online learning environment is briefly explained in Table 2.1 regarding its definition, advantages, and disadvantages for all online learning environments, namely hybrid, synchronous, and asynchronous.

Table 2.1
The Summary of Online Learning Environment

Online Learning Environment	Definition	Advantages	Disadvantages	Citation
Hybrid	The combination of synchronous and face-to-face methods	Student-centered learning Availability Increase engagement Easy access Flexibility	Procrastination Loss of discipline Less focus Insufficiently explained materials Lack of motivation	Amiti (2020) Susanthi, (2021) Pai et al., (2023) Ahmed et al., (2025)
Synchronous	Learning activities that are delivered by teachers in real-time or at the same time	Improve student engagement Encourage social presence Instance respond	Problems in connection Need earlier planning Technical issues Low self-efficacy	Susanthi (2021) Van Der Stap et al., (2024) Zhang et al., (2023) Olha (2021) Hung et al., (2024) Indriyani et al., (2024)
Asynchronous	Teachers and students communicate regarding learning tasks, like accessing information and learning materials at different times	Flexibility Freedom for students	Require responsibility Require discipline Exhausting Need high concentration Digital competency Lack of interaction No immediate feedback	Siregar et al., (2023) Alfares (2024) Akpomi (2023)

The researchers effectively demonstrate that hybrid, synchronous, and asynchronous learning environments each offer unique advantages and challenges in supporting effective online education. Hybrid learning provides a balanced combination of online and face-to-face interaction, which can increase flexibility and improve student engagement when properly implemented. Synchronous learning promotes real-time communication, allowing immediate feedback and fostering a sense of connection

and collaboration among students and teachers. Meanwhile, asynchronous learning supports self-paced study, giving students more control over their time and learning process, although it requires a high level of self-discipline and motivation. While all three modes contribute positively to the online learning experience, they must be carefully designed and supported with appropriate strategies and tools to ensure they meet students' learning needs. Collaborative technologies and strong instructional design play a key role in enhancing student engagement across these environments. Understanding the strengths and limitations of each mode is essential for educators and institutions to create inclusive, flexible, and effective learning experiences. Thus, the effective use of collaborative technology can strengthen student engagement by supporting interaction, communication, and shared learning across all modes.

2.4 Overview of Collaborative Technology

After discussing several online learning environments, it is important to examine the role of collaborative technology in supporting student engagement and effective learning. The innovation of technology has been rapidly growing nowadays, including software applications in the education infrastructure. The use of collaborative technology in education encourages collaboration activities for online learning, and various technologies have been used to enhance the teaching and learning process through comprehensive strategies such as recorded class video, online tutorials, online discussion, and more (Rathna Sekhar & Goud, 2024). Rathna and Goud also mentioned that by adopting a new modern teaching approach, teachers can identify their students' needs, creating more interactive, engaging, and effective learning experiences. According to Kaliisa et al., (2022), the integration of technology in education learning develops new skills for students in terms of technological skills and problem-solving skills. The use of collaborative technology enhances student engagement and learning outcomes. Kaliisa also explained that collaborative technology nowadays is developing to support various activities, including educational pursuits, and it has proven to be helpful in performing collaborative works such as collaborative learning.

Next, collaborative technology refers to an electronic device used to connect and have interaction between two or more people from different locations, and, as in an online learning context, it also enables teachers to interact with their students remotely and share knowledge effectively (Aman Deep Singh & Bhuyan, 2024). Yee & Yunus

(2021) also stated that collaborative technology can be referred to as task-specific collaborations with goals and work-oriented activities. According to Deschênes (2024), collaborative technology can refer to a technology application that is purposely used for collaborative work or activities that allow individuals to collaborate in completing their tasks. Based on the definition described by previous studies, the author briefly defines collaborative technology as a software application that is usually used to improve the quality of the online teaching and learning process.

Furthermore, collaborative technology is to support collaborative learning activities as well as increase student academic performance and achieve learning satisfaction (Alyami et al., 2023). Alyami also stated that collaborative technologies can be classified into several forms, which are chat tools, collaborative tools, video conferencing tools, and tools for sharing and creating documents. According to Emmanuel et al., (2024), there are several categories of collaborative tools that can be chosen depending on the learning objective to achieve, which are content creation and sharing tools, online discussion tools, project management tools, interactive learning platforms, file sharing and storage tools, and feedback and assessment tools. Understanding these categories is important for selecting the most suitable collaborative tools that align with specific learning goals and enhance the overall learning experience.

There are several collaborative tools that have been mentioned in previous literature that can be utilized to integrate collaborative technology to perform online teaching and learning. Fischer-Suárez et al., (2022) conduct a study that analyzes perceived aspects of using digital technology among nursing students as a collaborative tool discovered that by using the collaborative tools they perceived as beneficial, it improves their involvement and allows the students to gain better knowledge through their groupwork. Fischer-Suárez also suggested that the use of collaborative tools should be carried on for the next students as their new practice. Another study by Musick et al., 2023) conduct research on a group of students who use collaborative tools to complete their project courses to investigate their perception, and the findings of the study discovered that collaborative tools facilitate information sharing among team members. Musick also stated that collaborative tools provide the opportunity to help teammates understand better through information sharing. As part of digital learning, collaborative tools offer various features that help students and teachers work together more effectively.

Collaborative tools are digital platforms that can be used for collaborative work and sharing learning knowledge, and experience (Emmanuel et al., 2024). Emmanuel also stated that collaborative tools became crucial in online education after the pandemic era to perform learning tasks between teachers and students to assist teaching and learning sessions. According to Yee & Yunus (2021), collaborative tools are found to be useful in improving the effectiveness and quality of teaching-learning activities. Furthermore, there are several examples of collaborative tools which can be used for online education, such as video conferencing, audio conferencing, chat (instant messaging), file transfer applications, blogs, project management tools, email, e-learning platforms, and document sharing (Oyarzun, 2023).

Many previous studies have practiced the use of collaborative tools in performing the teaching and learning process according to their needs and motives of their learning. A study by Nasri et al., (2022) investigates the students' perceptions of using Google Docs as a collaborative tool in online learning, and the results show that it has a positive impact, as the students found this application to be helpful and facilitated their learning. Nasri also stated that the accessibility features in Google Docs are very helpful in completing their learning task and they increased students' learning motivation. Another study by Prasetya (2023) investigated the use of the Microsoft Teams application for English language learners to explore students' perceptions of the collaborative tools. The result of the study by Prasetya discovered that Microsoft Teams offers active participation and enhances interaction with their peers and teachers. Also, Prasetya stated that Microsoft Teams facilitated effective communication and feedback, which contributed to a positive learning experience. These findings highlight the effectiveness of collaborative tools in promoting student engagement, improving communication, and supporting meaningful learning experiences in online environments. To clarify between collaborative technology and collaborative tools, an illustration is provided in Figure 2.1 that shows the subgroup of collaborative technology that involves collaborative tools as a subset.

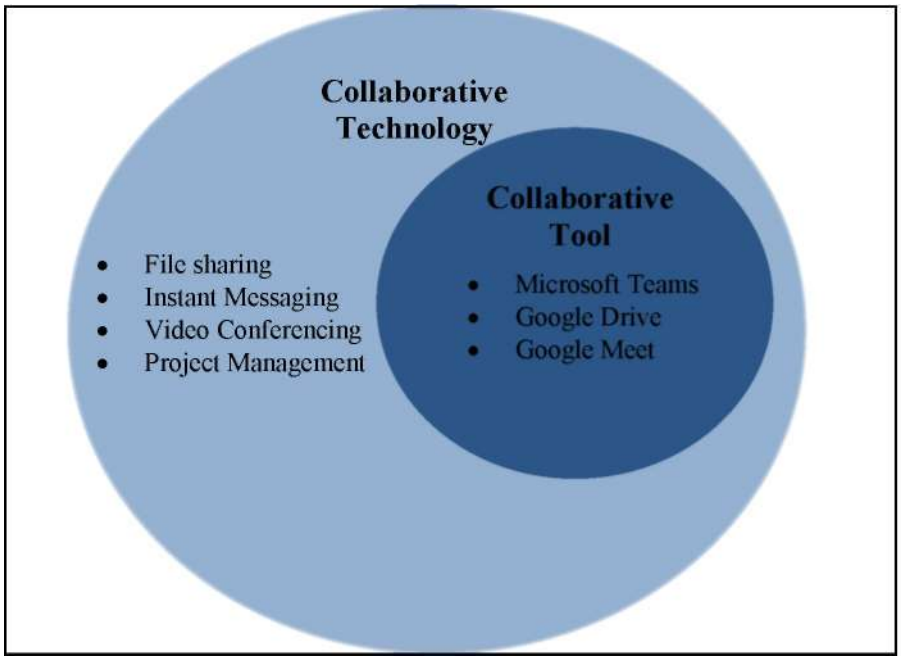


Figure 2.1 Subgroup of Collaborative Technology and Collaborative Tool

The researchers clearly show that the integration of collaborative technology in online learning environments plays a vital role in enhancing student engagement and improving the overall quality of the learning experience. As discussed, collaborative technologies offer a wide range of tools from video conferencing and online discussions to file sharing and project management that enable both teachers and students to communicate, interact, and collaborate effectively across different settings. These tools support not only the delivery of learning content but also the development of important skills such as technological literacy, problem-solving, and teamwork. Evidence from previous studies shows that students benefit greatly from the use of collaborative tools like Google Docs and Microsoft Teams, as these platforms foster active participation, motivation, and effective communication. Furthermore, by aligning the use of collaborative tools with specific learning goals, educators can create more engaging and inclusive online learning environments that support students' academic success.

Therefore, it can be concluded that the thoughtful application of collaborative technology is essential for teachers and institutions that aim to enhance student engagement and deliver meaningful online education. As technological innovation continues, the role of collaborative tools will remain central to shaping effective and interactive digital learning experiences. An alternative method of learning, utilizing collaborative technology, has become a strategy to achieve learning objectives

effectively, particularly when maximizing student engagement is considered. As mentioned, collaborative technology is a web application that can be used to conduct collaborative learning and share information online. Several collaborative tools are available to carry out online learning activities that bring opportunities to the student to collaborate with their peers. Many previous researchers have conducted investigations on using collaborative technology for online learning found that it helps achieve learning objectives as it has positive impacts on student motivation. In response to evolving educational technology, several types of collaborative technology platforms have been identified in the literature as essential tools to support online teaching and learning.

2.4.1 Types of Collaborative Technology

The implementation of online learning can be effectively supported through the integration of various collaborative technology platforms, each selected based on the specific objectives and pedagogical needs of the instructional context. Among the most widely adopted technologies are Learning Management Systems (LMS), Classroom Response Systems (CRS), and Web 2.0 tools. These platforms serve multiple functions, including facilitating content delivery, enabling real-time feedback, supporting asynchronous and synchronous communication, and promoting collaborative engagement among learners and instructors. As evidenced in numerous studies, such technologies play a vital role in enhancing the quality of the learning experience, improving interaction, and fostering student engagement across different online learning environments.

2.4.1.1 Learning Management System (LMS)

After exploring the context of collaborative technology in enhancing online learning, it is essential to explore specific platforms that support these functions. One of the most widely used systems in this context is the Learning Management System (LMS), which plays a crucial role in facilitating and organizing virtual teaching and learning activities. LMS is one of the software platforms or systems that support online learning activities by enabling communication, distribution of resources, and performing learning activities by using the features provided (Turnbull et al., 2021).

According to several studies, LMS has proven to support pedagogic requirements and offer both synchronous and asynchronous forms of communication (Al-Sharhan et al., 2020; Dlalisa & Govender, 2020). In addition, a study by Turnbull et al., (2021) reveals that the use of LMS for learning is effective and able to improve the efficiency and the sources of self-learning to manage discussion and perform collaboration. Furthermore, LMS demonstrated to promote motivation to the users, both students and teachers, and can enhance participation of the students in the classroom (Dlalisa & Govender, 2020). According to Al-Sharhan et al., (2020), there are numerous collaborative tools under LMS providers, namely Blackboard, Moodle, Desire2Learn, Canvas, MindTap, and many more.

Yakubu et al., (2020) mentioned the functions of LMS that make it an efficient tool, which provides tools for instruction, presentation of content, and communication functions. The tools for interaction used by student are to interact during learning session such as announcements for the latest news from peer or someone had reviewed the content, timetable for informing students about the timing of any events related to learning (lectures or meeting), tasks for the activities they need to perform sent by teachers, estimates for the student's assessment (formative or summative), user guide for the instructions in participating the course, and address book for the student to put data about their peers or members to communicate through the system (Munna et al., 2024). Moreover, the content presentation function within the course materials section allows the system to display text along with images and other resources, such as documents, books, and teacher-recommended references for students to study. It also includes links that direct students to important websites. Finally, the communication function enables interactions through tools like email, discussion boards, and virtual classrooms.

The researchers point out that the Learning Management System (LMS) serves as a vital platform in enhancing online learning by effectively supporting pedagogical needs through a variety of features. Its ability to facilitate both synchronous and asynchronous communication, distribute learning resources, and organize instructional activities contributes significantly to improving student motivation, participation, and self-directed learning. The diverse collaborative tools embedded within popular LMS platforms such as Blackboard, Moodle, and Canvas further enrich the teaching and learning experience by providing essential functions for interaction, content

presentation, and communication. Overall, LMS platforms play a central role in creating an efficient, interactive, and engaging online educational environment.

2.4.1.2 Classroom Response System (CRS)

After reviewing the role and functionalities of Learning Management Systems (LMS) in supporting online education, the discussion now turns to another important category of collaborative technology platforms. Another type of software platform that can be used for performing teaching-learning tasks in an online environment is Classroom Response Systems (CRS). CRS is described as a technological tool integrated in education to facilitate the process of teaching and learning, besides improving the effectiveness of classroom activities (Sprenger & Schwaninger, 2021). CRS is also called a Personal Response System, Audience Response System, Student Response System, Electronic Response System, and Electronic Voting System (Learning & Malekigorji, 2020). CRS was first introduced in the 1960s and was called an electronic response system, to give immediate feedback and to notify the instructors about their students' understanding (Lopez & Cabot, 2022). Classroom Response Systems (CRS) have key features such as presenting content and asking questions, collecting, and showing student answers, and managing and analyzing data. CRS allows teachers to ask questions, and students can respond immediately, making it easier and faster to evaluate learning outcomes. The system also calculates the responses right away and displays the results in charts or graphs (Ho & Tang, 2024).

Alviar & Gamorez (2024) stated that CRS effectively supports real-time formative assessment by enabling teachers to deliver instant feedback and allowing students to respond instantly using their smartphones. According to G. Pai & Pai (2025) the benefits of feedback provided by CRS are valuable not only for students but also for instructors, as it helps them identify which topics need further explanation and which ones students have already understood. Additionally, CRS has been found to encourage active learning and increase student participation by supporting communication between students and teachers in both small and large group settings.

The same goes as stated in the study by Leblanc (2025), the use of CRS in teaching significantly improves students' learning, in which students show satisfaction from the interaction with their teachers. Leblanc also highlighted that CRS is an effective tool for promoting active learning in the classroom. Furthermore, the implementation of CRS can increase student engagement, foster greater participation,

and facilitate peer interaction, while also offering valuable feedback opportunities for both students and instructors (Altwijri et al., 2022). The examples of commonly used Classroom Response System (CRS) tools include Kahoot, Quizizz, Socrative, Plickers, and RecaP, among others. These platforms offer interactive features that enable educators to engage students through real-time quizzes, polls, and feedback, thereby enhancing the overall learning experience. (Kiyancicek, 2022).

After reviewing CRS, it can be concluded that Classroom Response Systems (CRS) represent a significant advancement in collaborative educational technology, playing a crucial role in both online and traditional learning environments. By facilitating real-time interaction between instructors and students, CRS enables immediate feedback, which is essential for effective formative assessment. Additionally, the author believes that CRS promotes active learning by encouraging greater student participation and engagement through interactive quizzes, polls, and discussions, which foster a more inclusive and dynamic classroom atmosphere. Moreover, CRS enhances peer communication and collaboration, whether in small groups or larger classroom settings, contributing to a richer learning experience. The positive impact of CRS on student motivation and satisfaction is well-documented, as these systems make learning more enjoyable and interactive. With a broad range of tools available such as Kahoot, Quizizz, Socrative, Plickers, and RecaP, teachers have access to platforms that support diverse teaching goals and learning styles. Overall, the integration of CRS into educational practice not only strengthens the teaching and learning process but also bridges the gap between teachers and students, making education more responsive, engaging, and effective.

2.4.1.3 Web 2.0 Technologies

The use of digital tools in education has grown significantly, transforming how teachers and students interact and collaborate. One of the most notable developments in this area, other than LMS and CRS, is the rise of Web 2.0 technologies, which offer interactive and user-friendly platforms that support communication, content creation, and sharing (Ozbek, 2025). Web 2.0 refers to interactive web-based tools and applications that enable users to collaborate, communicate, and share content. These tools are widely used in educational settings due to their versatile instructional functions, including the creation and distribution of digital textbooks, infographics,

posters, quizzes, and other learning materials (Ghelani & Hua, 2022). The integration of Web 2.0 tools into teaching and learning environments has been shown to enhance student interaction and discussion, both within and beyond the classroom setting. These tools introduce innovative teaching approaches, support direct collaborative learning, and strengthen students' capacity to access, engage with, and retain new knowledge.

Qassrawi et al., (2023) indicates that the use of Web 2.0 tools can strengthen collaboration between students and instructors, improve learning effectiveness, and promote both social and active learning. Moreover, these tools contribute to increased student engagement, persistence, and participation, which collectively support higher academic achievement and progress toward educational goals. Other benefits mentioned by Chisunum & Nwadiokwu (2024) are enhancing access to educational resources, supporting student academic performance, fostering skill development, enabling effective knowledge management, and offering specialized tools tailored to specific subject areas. It also enables users to create and distribute content with ease, thereby enhancing collaborative work. Based on a study by Qureshi et al., (2021) Web 2.0 technologies have a positive influence on students' thinking, motivation, and participation, which helps improve collaborative learning and supports academic success. These tools also enhance teaching and learning activities through features such as video sharing, collaborative platforms, and mobile access. Common Web 2.0 platforms such as Facebook, YouTube, and Twitter are increasingly being used in higher education settings, supported by their growing number of active users (Sengupta & Vaish, 2023). Web 2.0 applications include a wide range of tools that support communication, collaboration, and content sharing in education. These tools come in different forms, such as blogs, instant messaging, social bookmarking, social networking sites, wikis, video-sharing platforms, and audio or video conferencing tools. It allows students and teachers to interact, share ideas, and work together in real time or at their own pace, which helps improve the overall learning experience (Biradar, 2025).

The previous studies make it clear that collaborative tools are a part of collaborative technology that can be utilized for performing online learning processes and supporting collaborative learning. Collaborative tools consist of different types, and the most known are Learning Management System (LMS), Classroom Response System (CRS), and Web 2.0 technologies. All of these tools not just facilitate online learning, but to perform online assessment as well. Each of the platforms offers different features in competing learning activities. Teachers have the liberty to choose which

platforms are suitable for the requirements. All of the platforms are found to help improve the learning experience with high student engagement. According to past studies done by previous researchers on using collaborative to perform online learning seems to show a positive impact and makes learning more effective.

Collaborative technology includes tools like Google Classroom, Microsoft Teams, Zoom, Padlet, and Google Docs, which help students work together and communicate. Their effectiveness depends on students' needs, teachers' skills, and the learning setting. Different tools support different types of engagement. Google Docs encourages active work and teamwork because students can edit and comment together. Zoom or Google Meet supports social and verbal interaction through live discussions. Padlet helps with idea-sharing and creativity. This shows that each tool has a specific purpose and no single tool supports all types of engagement. Overall, collaborative technology can increase behavioural, cognitive, and social engagement, but only if the right tools are chosen and used effectively, and all students receive equal support. The use of collaborative tools in online learning has a positive impact on student outcomes and makes the learning process more effective. This improvement is largely due to the nature of collaborative learning, which emphasizes active participation, communication, and cooperation among students. The next section will elaborate more on collaborative learning.

2.5 Overview of Collaborative Learning

In recent years, technology-enhanced education has brought new approaches to teaching and learning, and among these approaches, collaborative learning has gained significant attention due to its focus on student interaction and teamwork. According to what has been investigated by previous researchers, collaborative technology is found to be useful in supporting collaborative learning activities (Dewitt 2020; Van Der Meer et al., 2023). Collaborative learning is an approach that requires two or more individuals, usually in a group, to work together on a learning task, sharing information towards learning to achieve learning goals and enhance learning activities (Ramzan, 2023). The term collaborative learning can also be explained as one of the methods of active learning that helps instructors to facilitate learning to improve students' performance, and it is able to increase students' critical thinking, cognitive performance, and social relationships (Qureshi et al., 2023). The idea of collaborative learning was

first formed by a group of teachers in one university in the 1960s and later followed by other teachers globally (Yang, 2023). Yang also said it is proven that collaborative learning improves the process of learning as it becomes more comprehensive, more challenging, and it is found to be effective.

Collaborative learning is implemented interchangeably with cooperative learning, that are more structured. Cooperative learning is one of the teaching strategies in which students are organized by the teacher to work together in a group and do the learning task together through interdependent behavior to achieve the learning goal. Collaborative learning and cooperative learning both involve students working together, but it is different in structure and focus, as collaborative learning is informal, where students will lead and explore the task, while cooperative learning is structured by the teacher (Abramczyk & Jurkowski, 2020; Jou, 2024). Based on descriptions from past researchers, the author defines collaborative learning as performing learning activities in a group to achieve learning objectives.

Previous studies stated that passive learning by listening to the lectures is less effective than group work, and the reason why many institutions employed a new style of learning is to promote active learning classrooms (Lombardi et al., 2021). In addition, Lombardi discovered that students achieve a higher level of active engagement and participation in an active learning classroom. Traditionally, collaborative learning is carried out physically, in which students have a face-to-face discussion and do revision. After the emergence of new innovative technologies, online collaborative learning has become the main practice worldwide (Almusharraf & Bailey, 2021). The implementation of online collaborative learning is better than traditional one due to its effectiveness. Next, S. Lu & Smiles (2022) stated that several studies reveal that learning can become effective when students have the opportunity to work collaboratively, express their thoughts, discuss ideas, and work together to find solutions for learning problems.

According to Jeppu et al., (2023), there are several advantages to implementing collaborative learning. First, it helps students develop teamwork skills and the ability to reach agreements despite differing opinions or ideas. Second, it gives them the chance to consider diverse perspectives and critically reflect on their understanding of issues. Finally, it enables students to solve problems and complete tasks effectively in an online learning environment. Moreover, a study discovered that collaborative technology used to perform collaborative learning has a significant contribution to students' academic

performance, and their learning satisfaction also helps students in completing their learning tasks together with their peers (Chamorro-Atalaya et al., 2022). The purpose of collaborative learning is to form the cooperative character of the students from an early age and capable of solving the problems together, and it also encourages the emergence of discussions and provides new knowledge to each other (Usman et al., 2022).

Other benefits of online collaborative learning are better group availability and flexibility, more transparency, better decision-making process, and greater knowledge development (Busch et al., 2021). Plus, it can expand a student's knowledge by sharing ideas and getting new knowledge from each other. Furthermore, Al-yafaei et al., (2023) stated that collaborative learning is beneficial to students compared to traditional learning because the students can actively engage in the learning process through interaction and collaboration with their peers, and collaborative learning also offers another benefit, such as critical thinking and group skills mastered by students. Besides, collaborative learning can be performed in various ways with the support of collaborative technology such as online discussion platforms and representational or simulation tools that support pedagogical activities, depending on the collaboration ways needed, whether face-to-face, synchronously, or asynchronously (Jovanovic & Milosavljevic, 2022).

Next, Susanthi (2021) said that the key to a successful online class is to evaluate and select suitable communication tools that are pertinent to the teacher's pedagogy, the needs of the learner, and course objectives. Susanthi also stated that categorizing tools by synchronous and asynchronous helps in identifying the configuration of activities. Synchronous can be simply explained as the live communication or interaction process, while asynchronous is otherwise. The common examples of synchronous tools are chats and video-conferencing, and for asynchronous tools are e-mails and forum discussions. Collaborative technology that supports the function of performing synchronous and asynchronous learning modes allows students to collaborate with peers anytime and from anyplace (Davidson-Shivers & Rand, 2023). Thus, collaborative learning can be effectively facilitated through various forms of collaborative technology that can be selected based on their appropriateness for completing specific learning tasks and achieving intended educational outcomes. The summary of advantages of collaborative learning to student engagement is briefly explained in Table 2.2 regarding the several advantages that are found from past studies.

Table 2.2
The Advantages of Collaborative Learning to Student Engagement

Advantages of collaborative learning to student engagement	Citation
Facilitate learning to improve students' performance Increase student critical thinking Increase students' cognitive performance Increase social relationships	Qureshi et al., (2023)
Learning becomes more comprehensive Learning more challenging Effective learning	Yang (2023)
Effective collaborative work Problem solving in group	S. Lu & Smiles (2022)
Students learn how to work in team Problem solving skills	Supena et al., (2021)
Positively improve students' academic performance Improve learning satisfaction	Chamorro-Atalaya et al., (2022)
Group availability and flexibility Better decision-making	Busch et al., (2021)
Improve engagement through interaction and collaboration with their peers	Al-yafaei et al., (2023)

From the discussion on previous literature, it can be inferred that collaborative learning helps in improving online learning quality with the use of collaborative technology. Whether performing collaborative learning online or face-to-face, it has been proven to be effective in helping students achieve their learning goals. Collaborative technology used to perform collaborative learning has contributed to the development of new skills to improve their academic experience. Also, collaborative learning provides new competencies for student to show their cooperative character to socialize during the lesson. Many existing collaborative technologies can be used for collaborative learning, and choosing the right tools has a significant impact on the online learning focus. Plus, it depends on contemporary needs. It can be concluded that when collaborative learning is supported by suitable collaborative technologies, it plays a vital role in enhancing the quality of online education. It not only helps students achieve their academic goals but also fosters essential skills such as cooperation, communication, and self-regulation. However, despite its benefits, the effectiveness of collaborative learning in online settings is often challenged by low levels of student engagement. These challenges stem from factors such as a lack of interaction, motivation, and active participation. Therefore, selecting appropriate collaborative tools and designing meaningful activities are crucial steps toward addressing engagement

issues and creating a more dynamic and inclusive online learning environment. While collaborative learning supports academic success, the effectiveness of online education often depends on how well student engagement is sustained. The next section will elaborate more on the challenges of student engagement in an online learning environment.

2.6 Student Engagement Challenges in Online Learning

The online learning environments have introduced several challenges related to student engagement. The challenges of student engagement are identified in past literature, which reveals low levels of student engagement in online classrooms. Strategies of enhancing engagement have been actively searched to help student in their learning. One of the existing challenges stated in a study by Richards (2023) is students show low levels of interaction and motivation during teaching and learning activities, and they also have limited opportunities to connect with peers for social and emotional support. Richard added that there is a lack of opportunities for group activities, fewer interactions with peers and teachers, a low sense of classroom community, and Zoom fatigue.

Next, Fatokun (2024) agrees that online student engagement is difficult because there is a lack of interaction with teachers, no immediate feedback like in person, no enthusiasm, and low interpersonal interaction among their peers. Fatokun also mentioned that all of these problems may lead to poor learning outcomes because it affects student performance. In a different context, it is also challenging for the teachers, as stated by Lestrade et al., (2025), there is difficulty in assessing student engagement and social presence effectively. Lestrade explained that assessing students' engagement and promoting social presence becomes a significant challenge in an online learning context. The author discovered that it is suggested to integrate the use of collaborative technology since it can help as a strategy to enhance social presence to promote collaboration in distance learning.

Another study by Ilmiah et al., (2024) describes challenges in online learning, which are technological challenges, pedagogical challenges, and social challenges. The first challenge is the difficulty in accessing the technology devices, internet connection, and teachers with a lack of knowledge in using technology. Secondly, pedagogical challenges relate to the need to set up teaching material such as images, animations, and

games to engage and maintain student motivation. Lastly, social challenges mean a lack of a home environment for learning convenience. In addition to these, Ilmiah also highlights a major concern: the difficulty in identifying student engagement during online learning. It was discovered that students who lack technological skills are less likely to actively participate, which further reduces their engagement in online classrooms.

Next, Bai et al., (2023) pointed out a challenge in which students often experience discouragement when attending teaching and learning sessions, either online or face-to-face discussions, because they are disinterested and lack motivation to participate in the session. Students who are not engaged in their learning are more likely to perform poorly in their studies. Moreover, a study by Maimaiti et al., (2021) reveals several factors that affect student engagement, which include a lack of timely responses from their peers in online discussions, unclear instructions, and technical problems. Besides, another research by Hew, Khe Foon (2023) describes three major challenges in online learning that cause low student engagement: students being more easily distracted, students lacking self-regulation skills, and students feeling isolated. The criteria of student disengagement are that they are not participating in online learning sessions. Besides, the author also discusses three possible strategies to overcome the challenges: promoting active learning using online flipped learning, promoting self-regulation skills, and reducing the sense of isolation. The summary of student engagement challenges in the online learning environment can be referred to Table 2.3.

Table 2.3
Challenges in Online Learning

Online Learning Challenges	Citation
Lack of interaction and motivation Low sense of classroom community Zoom fatigue	Richards (2023)
No immediate feedback, like in person No enthusiasm Low interpersonal interaction	Fatokun (2024)
Difficulty in assessing student engagement Technological challenge Pedagogical challenge Social challenge	Ilmiah et al., (2024)
Discouragement to attend teaching and learning sessions Lack of student engagement	Bai et al., (2023)
Low student engagement Students are being more easily distracted Students lacking self-regulation skills Students feel isolated	Chamorro-Atalaya et al., (2022)
Group availability and flexibility Better decision-making	Buschetal., (2021)
Improve engagement through interaction and collaboration with their peers	Hew & Khe Foon (2023)

According to Table 2.3, which reveals the challenges in online learning from various literature, the issue of sustaining student engagement in online learning remains a main concern. The problem elements, such as low interaction, limited motivation, lack of timely feedback, unclear communication, technological barriers, and social isolation, all contribute to the disengagement of students in virtual classrooms. These challenges not only affect students' academic performance but also place pressure on teachers to find effective strategies to maintain engagement. The difficulty in assessing and promoting student presence online further complicates the situation. However, as suggested in the literature, the integration of collaborative technologies, active learning methods, and support for self-regulation skills may help overcome these obstacles. Addressing these challenges is essential to improve the overall quality and effectiveness of online education. To better understand how these challenges impact learning, it is important to first examine the concept, criteria, and dimensions of student engagement within the context of online education.

2.7 Overview of Student Engagement

To address the issues outlined above, a deeper look into student engagement and its role in online learning is necessary. Student engagement is significant in an online learning environment as it is a crucial element in ensuring students' active learning. Student engagement refers to a student-centered approach that focuses on students' connectedness, involvement, effort, energy, and time (Ferrer et al., 2022). According to Cumbest (2022), student engagement is energy in action as it is able to enhance students' achievement, retention, and graduation, acquisition of knowledge and skills, and improved emotional function. Next, Chiu (2022) defined student engagement as students' commitment and active involvement towards educational goals and effective educational practice. Besides, Kristiana et al., (2024) described student engagement as the time and energy students spend on learning activities either inside or outside the classroom. Further, student engagement is usually interrelated with participation or involvement in the learning process (J. D. Salayo et al., 2021). Based on previous definitions, the author defined student engagement as students' interest and effort towards learning activities both inside or outside the classroom.

Promoting student engagement in an online context brings benefits in improving learning experiences and outcomes. As stated by Nkomo et al., (2021), students who are actively engaged with collaborative tools tend to perform better in their learning compared to inactive students. Student engagement can enhance students' achievement, retention, acquisition of knowledge and skills, and improved emotional functioning (Havik & Westergard, 2020; Zen et al., 2022). Besides, student engagement protects against risky adolescent behaviors. Another benefit, as stated by Ma & Chen (2024) is student engagement in learning is superior for promoting students' motivation to learn, academic achievement, and persistence in their academics. In addition, Ma & Chen also stated that positive attitudes and learning skills can help students to remain active in the learning process and make it better in learning outcomes. Therefore, there is a need to promote student engagement and use proper teaching methods and strategies with learning technologies, or specifically collaborative technologies (Heilporn et al., 2021; Adiyono et al., 2024).

Moreover, Thomas & Nair (2023) stated that student engagement can be influenced by both student and teacher factors. Besides, another researcher found that student engagement can be influenced by demographic characteristics such as age,

digital literacy, and educational background (Widowati et al., 2023). As well, how institutions design their learning environment also affects student engagement in their learning (Nkomo et al., 2021). In the past, literature stated that the essential factors of successful student engagement in an online learning environment are formal and informal community, time management and organization skills, engaging and supportive online teachers, multiple means of interaction, opportunities for skill development, confidence building, and self-regulation (Salayo, 2021; Lasekan et al., 2024). However, Faro et al., (2025) concisely mentioned in the study that student engagement is energized by motivation and fostered by various contextual factors such as teachers, peers, and environmental support.

After exploring the definition of student engagement, the author concludes that student engagement refers to the level of active participation, emotional investment, and commitment that students show in their learning process. In online learning environments, engagement is closely linked to improved academic performance, knowledge retention, motivation, and emotional well-being. It is shaped by various factors, including student and teacher behavior, digital literacy, learning environment design, and the use of appropriate teaching strategies and technologies, particularly collaborative tools. Student engagement is not only essential for enhancing learning outcomes but also for building essential skills such as self-regulation, confidence, and effective communication, while fostering a sense of community and persistence in learning. The summary of the overview of student engagement is briefly explained in Table 2.4 regarding the definitions that are interpreted by past researchers.

Table 2.4
The Definition of Student Engagement

Definition	Citation
Student-centered approach that focuses on students' connectedness, involvement, effort, energy, and time	Ferrer et al., (2022)
Energy in action can enhance students' achievement, retention, and graduation, acquisition of knowledge and skills, and improved emotional function	Cumbest (2022)
Students' commitment and active involvement towards educational goals and effective educational practice	Chiu (2022)
The time and energy students spend on learning activities, either inside or outside the classroom.	Kristiana et al., (2024)

In summary, students' academic success is strongly influenced by their engagement in the learning process. When students are highly engaged, they tend to achieve better results. Student engagement is especially important in online learning, as it reflects the effectiveness of the learning sessions. Because many factors can affect engagement, it is important to identify and address these issues to improve student motivation and support better learning outcomes. To better understand student engagement, it is important to explore its different dimensions, which capture the various ways students participate and connect with their learning.

2.8 Dimensions of Student Engagement

Following the discussion on the concept of student engagement, the focus now shifts to exploring its key dimensions. Student engagement basically consists of several dimensions that represent different types of engagement. This research considers the most used dimension by all researchers. According to previous research, student engagement is often conceptualized as three dimensions, which are behavioral, cognitive, and emotional, as shown in Figure 2.1 (Nkomo et al., 2021). Several researchers classify the dimensions of student engagement along with other dimensions which are academic, intellectual, institutional, social, and psychological but most studied as multidimensional of interrelated subtypes (behavioral, emotional, cognitive) (Bond & Bergdahl, 2022; Roman et al., 2022; Wong & Liem, 2022) The same goes to a study by Roman et al., (2022), student engagement has three interrelated dimensions (behavioral, emotional, and cognitive). All the student engagement dimensions focused on different aspects, which means, behavioral engagement is described as effort and persistence towards the activities, including extracurricular, social, and academic (e.g., participation). Meanwhile, emotional engagement refers to reactions towards learning or peers and teachers (e.g., showing interest, boredom), and cognitive engagement refers to their knowledge or metacognitive and learning strategies (e.g., understanding of their learning) (Havik & Westergard, 2020; Heilporn et al., 2021; Nkomo et al., 2021; Alamsyah & Nuha, 2024).

However, there are another researcher stated that there are four-dimensional of student engagement that consist of behavioral engagement, such as attendance and participation, emotional engagement means students experience emotional responses such as interest and enjoyment, cognitive engagement means students who use

sophisticated learning strategies, and agentic engagement means students proactively attempt to enrich their learning experience (X. Xu et al., 2023). Also, as stated by Derakhshan et al., (2022), student engagement is conceptualized as a multicomponent construct that consists of behavioural, cognitive, emotional, and agentic engagement.

Student engagement in the classroom has been conceptualized through two different but related perspectives, which are the behavioral perspective of student engagement that focuses solely on the behavioral dimension of engagement, such as time and effort, and the relation of certain behaviors to students' achievement. However, this perspective may diminish equally important aspects of student engagement that are also related to students' psychological state, such as the students' investment in their learning and emotions. Therefore, the second is the psychological perspective of student engagement that includes several dimensions of engagement, including one that is related to behavioral, cognitive, and emotional aspects (Naibert et al., 2022).

Based on previous discussion, the author concluded that student engagement is a multidimensional construct that encompasses several interrelated aspects of student involvement in the learning process. While most researchers agree on the three core dimensions, which are behavioral, emotional, and cognitive, some studies have expanded this framework to include a fourth dimension, agentic engagement, which highlights students' proactive role in shaping their own learning experiences. Each dimension reflects a different component of engagement: behavioral engagement focuses on participation and effort, emotional engagement captures students' feelings towards learning, cognitive engagement involves the use of deep learning strategies, and agentic engagement emphasizes students' initiative and autonomy. Understanding these dimensions is essential for educators to develop effective strategies that promote comprehensive student engagement, especially in online learning environments. The summary of the dimension of student engagement is briefly explained in Table 2.5 regarding the number of multidimensional aspects stated by different previous researchers to be analysed for this research.

Table 2.5
The Dimension of Student Engagement

Dimension of Student Engagement	Citation
Behavioral, Emotional, Cognitive	Nkomoetal., (2021)
Behavioral, Emotional, Cognitive	Wong & Liem (2022)
Behavioral, Emotional, Cognitive	Roman et al., (2022)
Behavioral, Emotional, Cognitive, Agentic	X. Xu et al., (2023)
Behavioral, Emotional, Cognitive, Agentic	Derakhshan et al., (2022)
Behavioral, Emotional, Cognitive	Naibert et al., (2022)

In addition, the frameworks based on the psychological perspective can be single or multidimensional (Naibert et al., 2022). The frameworks consist of multiple overlapping dimensions that include the interrelated behavioral, cognitive, and emotional components and emphasize that these dimensions should be evaluated simultaneously to better assess the complex construct of student engagement and consider any effects due to the overlapping nature of the dimensions. Naibert suggests that when evaluating student engagement, a multidimensional engagement framework can provide a more complete perspective of student engagement than simply focusing on a single component. Therefore, this research will focus on three multidimensional aspects of student engagement, which are behavioral, emotional, and cognitive engagement.

2.8.1 Behavioral Engagement

To begin with, student engagement can be better understood by examining each of its core dimensions one by one. Each dimension of student engagement is reflected through different types of activities. According to the dimension, for instance, behavioral engagement includes tasks like fulfilling assignments and being involved in student organizations (Gomes et al., 2023). As mentioned in section 2.7, behavioral engagement refers to students' reactions towards feedback, such as asking for clarification. Meanwhile, in an online learning environment, behavioral engagement may refer to actions or behaviors that a student shows in relation to feedback (Fleckenstein et al., 2024). Next, as stated by Schiller et al., (2024), behavioral engagement refers to students' active participation in learning activities, and it is most strongly related to students' achievement. Plus, behavior reflects students' engagement during the teaching and learning session. Behavioral engagement is the concern of

students' efforts, compliance, concentration, and active participation in various classroom activities over a learning course (Derakhshan et al., 2022).

The author summarizes that behavioral engagement is an important part of student engagement that can be seen through students' actions and participation in learning. It includes completing assignments, j oining class activities, and responding to feedback from teachers. Researchers have shown that behavioral engagement is closely connected to students' efforts, attention, and involvement in the learning process. This type of engagement also plays a strong role in improving academic achievement. Whether in a traditional classroom or an online setting, supporting behavioral engagement helps students stay active in their learning and succeed in their studies.

2.8.2 Emotional Engagement

After discussing behavioral engagement, the next focus is on emotional engagement. Emotional engagement was the most essential type of engagement in predicting students' behavior intentions. Students who lack emotional engagement are most likely to disengage both behaviorally and cognitively. Emotional engagement is divided into two categories, which are positive emotional engagement, such as enjoyment and pride, and negative emotional engagement, such as boredom and anxiety (Tu et al., 2025). Specifically, emotional engagement refers to students' affective reactions, such as their positive or negative responses towards learning. Shakki & Pikhart (2023) mentioned that emotions are crucial for online student attention, engagement, and persistence. Shakki also stated that emotional engagement can be demonstrated through text, pictures, facial expressions, and gestures. Besides, the trouble of forming social and emotional connections is the biggest obstacle to student success in an online environment. Briefly, emotional engagement is students' affective reactions towards learning, including the value of learning in an online context and emotional states or feelings such as happiness, interest, boredom, and sadness (Ma & Chen, 2024). Emotional engagement concerns students' inner feelings and emotions and their reactions towards the learning process (Derakhshan et al., 2022). Emotional engagement is considered to directly affect learning outcomes and indirectly affect behavioral and cognitive engagement.

The author believes that emotional engagement is an important part of student engagement that strongly affects learning outcomes. It includes how students feel about

learning, such as positive emotions like enjoyment and pride, or negative emotions like boredom and anxiety. Emotional engagement also influences how students behave and think during the learning process. In online learning, emotional engagement is especially important, as students often face challenges in building emotional and social connections. When students are not emotionally engaged, they are more likely to lose interest and stop participating. Therefore, supporting students' emotional engagement is key to helping them stay motivated and succeed in their learning. Moreover, emotional engagement helps students stay focused, motivated, and connected to their learning goals. It also supports their willingness to continue learning, even when facing difficulties. Teachers need to pay attention to students' emotions and create a supportive learning environment that encourages positive emotional experiences. By doing so, they can improve not only emotional engagement but also students' overall academic success.

2.8.3 Cognitive Engagement

After addressing emotional engagement, the next focus is on cognitive engagement, the last dimension of student engagement. Cognitive engagement is the process by which students become cognitively and strategically invested in their learning (Alam & Mohanty, 2024). Accordingly, students who cognitively engage with the teaching and learning process will put on an effortful learning strategy. Students with high knowledge might be more capable of using effortful learning strategies to structure their learning. Plus, active cognitive engagement relies on individual characteristics (Kuhlmann et al., 2024). Cognitive engagement refers to students' effort, persistence, resilience, concentration, paying attention, and contributing to the learning process (Q. I. Xu et al., 2023). Measuring cognitive engagement can improve academic achievement. Therefore, we can assess students' cognitive engagement level by observing their behavior. For example, head posture (moving or not), eye movement (staring or not), and facial expression (laughing or not) (Q. I. Xu et al., 2023). Cognitive engagement is a psychological investment that students make during learning through the application of mental strategies in a course (Derakhshan et al., 2022). Moreover, the nature of students' social interaction may influence their cognitive engagement in the learning environment, and students' level of cognitive engagement in the learning environment is an important indicator of its effectiveness (Dunmoye et al., 2024).

The author concludes that cognitive engagement is equally important in the dimension of student engagement. It refers to students' mental effort and strategic investment in their learning, including behaviors such as concentration, persistence, resilience, and the use of effective learning strategies. When students are cognitively engaged, they are more likely to approach learning with deep thinking, apply knowledge actively, and take responsibility for their academic progress. This form of engagement shows that students are not just participating, but are mentally involved and committed to understanding the content. Cognitive engagement is influenced by both internal factors, such as a student's motivation and prior knowledge, and external factors, including the learning environment and quality of instruction. Social interaction in the classroom or online setting can also shape how much a student engages cognitively. Furthermore, educators can assess cognitive engagement through observable behaviors like eye movement, facial expressions, and body posture, which provide useful insights into students' level of involvement. Supporting cognitive engagement is essential for promoting meaningful learning and long-term academic success. By encouraging students to think critically, reflect deeply, and stay focused, educators can create learning environments that not only improve academic achievement but also foster lifelong learning habits.

The summary of the multidimensional of student engagement in an online learning environment is briefly explained in Table 2.6 regarding its descriptions for each student engagement dimension, namely behavioral, emotional, and cognitive.

Table 2.6
The Description of the Dimension of Student Engagement

Dimension	Description of the dimension of student engagement	Citation
Behavioral Engagement	The student is doing the assigned task and joining the student committee	Gomes et al. (2023)
	Students' actions or behaviors that student shows in relation to feedback	Fleckenstein et al. (2024)
	Students' active participation in learning activities is most strongly related to students' achievement.	Schiller et al. (2024)
	Students' efforts, compliance, concentration, and active participation in various classroom activities over a learning course	Derakhshan et al. (2022)
Emotional Engagement	Positive emotional engagement, such as enjoyment and pride Negative emotional engagement, such as boredom and anxiety	Tu et al., (2025)
	Students' affective reactions towards learning and emotional states or feelings such as happiness, interest, boredom, and sadness	Ma & Chen (2024)
	Emotional engagement can be demonstrated through text, pictures, facial expressions, and gestures.	Shakki & Pikhart (2023)
	Students' feelings and emotions, and their reactions towards the learning process	Derakhshan et al. (2022)
Cognitive Engagement	The psychological investment that students make during learning through the application of mental strategies in a course	Derakhshan et al. (2022)
	The process by which student become cognitively and strategically invested in their learning	Kuhlmann et al. (2024)
	Cognitive engagement refers to students' effort, persistence, resilience, concentration, paying attention, and contributing to the learning process.	Q. I. Xu et al. (2023)

After exploring the dimensions of student engagement, the author believes that student engagement can be best understood by examining its three main dimensions: behavioral, emotional, and cognitive engagement. Each of these dimensions highlights different ways students interact with and respond to the learning process. To fully represent a student's engagement, they must demonstrate characteristics from all three areas. Research consistently shows that students who are highly engaged in online learning environments tend to perform better academically, highlighting the importance of fostering engagement across these dimensions. While some researchers propose adding agentic engagement as a separate dimension, it shares many similar qualities

with behavioral engagement and is therefore often considered part of it. Given this overlap, focusing on the three core dimensions provides a clearer and more practical framework for measuring and understanding student engagement. By focusing on behavioral, emotional, and cognitive engagement, teachers and researchers can more effectively identify ways to support students' involvement and success, particularly in online learning settings where engagement can be more challenging to maintain. Overall, recognizing and promoting all three dimensions of engagement is essential for creating effective learning environments that encourage students to participate actively, feel emotionally connected, and invest cognitively in their education. Besides, the dimensions used to represent criteria for assessing the depth and quality of student engagement in any learning environment, especially in online contexts, where such engagement is often harder to observe and sustain.

2.9 Criteria of Student Engagement

Student engagement in online learning can be better understood by observing specific characteristics that indicate active participation and interest. Ensuring whether the students are engaged in online learning is through their criteria they show. There are several characteristics identified to determine students who are engaged. Students who are engaged will pay attention and participate in discussions, and will make an effort to be involved in learning activities, show interest, and be motivated to learn (Havik & Westergard, 2020; Salhab & Daher, 2023). Besides, students who are engaged can be characterized by enthusiasm, interest, belonging, deep learning, self-regulation, time and effort invested in studying, interaction and participation, feelings of autonomy, and choice and control (Fisher et al., 2021; Dieu, 2024). There are many previous studies that investigate how to engage students in the teaching-learning process. According to Indra et al., (2023), collaborative technology is able to enhance student engagement and active participation in classrooms, and it can also help teachers in making new strategies to engage students in an effective way. Gopinathan et al., (2022) mentioned that one of the purposes of using collaborative technology is to enable students' participation and engage in student learning activities.

A study by Sarah (2025) describes that students who are engaged will be fully present, connected, invested, and focused during the online learning session. Sarah also mentioned that student engagement is about students listening, contributing, and

interacting during online learning sessions beyond just appearing in the session. Also, the sense of being present in the session and communication with the teacher and their peers. The feeling of student engagement can also be seen when students' contributions to their learning task, such as answering the questions, included how they demonstrated their answer in completing the task (Rianita, 2022). James et al., (2024) stated the criteria of student engagement for each dimension, including enthusiasm and interest for emotional engagement, time and effort, interaction, and participation for behavioral engagement, and deep learning for cognitive engagement. James also mentioned that students will learn better when they are active and engaged during the session.

After exploring the criteria, the author believes that student engagement in online learning can be effectively identified through specific characteristics that reflect their active participation, interest, and involvement in the learning process. Engaged students show clear signs of attention, motivation, interaction, and effort in their learning activities. These characteristics include enthusiasm, a sense of belonging, self-regulation, and meaningful contributions during online sessions. Previous research has shown that engagement is not just about being present but also about being mentally and emotionally involved through listening, contributing, and interacting with teachers and peers. Collaborative technology plays an important role in supporting this engagement by encouraging participation and helping educators develop more effective teaching strategies. Overall, understanding the criteria of student engagement across behavioral, emotional, and cognitive dimensions is essential in ensuring that students are truly connected to their learning, which ultimately supports better academic outcomes in online education. The summary of the criteria of student engagement is briefly explained in Table 2.7 regarding its criteria that are found from past literature.

Table 2.7
The Criteria of Student Engagement

Criteria of Student Engagement	Citation
Pay attention and participate in discussions Will make an effort to be involved in learning activities Show interest in learning Motivated to learn	Havik & Westergård (2020) Salhab & Daher (2023)
Enthusiasm Showing interest Belonging Show deep learning Self-regulation Invest in time and effort Show positive interaction Participate Feelings of autonomy	Fisher et al., (2021) Dieu (2024)
Fully present Show connection Invested in learning Focused during the online learning session Listening, contributing, and interacting	Sarah (2025)
Enthusiasm Interest Time and effort Interaction Participation Deep learning	James et al., (2024)

After exploring the concept of student engagement, including its dimensions, behavioral, emotional, and cognitive, and the criteria used to identify engaged students, it is important to examine how student engagement can be measured. Understanding engagement becomes especially important in online and digital learning environments, where active participation is more difficult to observe. In this context, the author now focuses on exploring existing frameworks and models that have been developed by previous researchers to measure student engagement, particularly in relation to the use of collaborative technology. To identify the most suitable approach for this research, the author surveys and compares existing frameworks and models used in past research. The frameworks and models help researchers and educators assess how effectively students interact, participate, and stay motivated while using digital tools for learning.

2.10 Existing model and theoretical framework of student engagement and collaborative technology

During the review of past literature, several models and theoretical frameworks related to student engagement and the use of technology were identified. These frameworks and models vary in their focus, structure, and approach, reflecting the diverse ways in which student engagement can be understood and measured. Additionally, many frameworks incorporate the role of technology as a tool to enhance collaboration, communication, and active learning, especially in online or blended learning environments. Because each framework is developed with specific research goals or educational contexts in mind, they are expected to yield different outcomes and insights when applied. Understanding the strengths and limitations of these models is essential for selecting the most appropriate framework that aligns with the objectives of this research, particularly in measuring student engagement in relation to collaborative technology use.

2.10.1 Student Engagement Model by Nkomo

Understanding how students connect with their learning requires a clear framework for defining engagement. According to Nkomo et al., (2021b), student engagement is often conceptualized along three dimensions: behavioral, cognitive, and emotional. While the three dimensions of engagement can be seen as separate, they often overlap in practice. For instance, efforts and attention typically associated with behavioural engagement can also be interpreted as aspects of cognitive engagement. Nkomo also stated that there is another proposed dimension, which is agentic engagement, which emphasizes students' active and intentional role in shaping their own learning experiences. This form of engagement reflects the students' ability to contribute purposefully and improve the learning process. However, agentic engagement can also be viewed as a combination of both cognitive and behavioral elements, rather than a completely separate category. The author believes that integrating the three core dimensions offers a deeper understanding of how students engage with learning. Therefore, considering all dimensions is essential when measuring student engagement, as focusing on only one may give an incomplete picture. The interplay between behavioral, cognitive, and emotional engagement can

vary widely among students, highlighting the importance of a comprehensive approach. Student engagement models are shown in Figure 2.3.

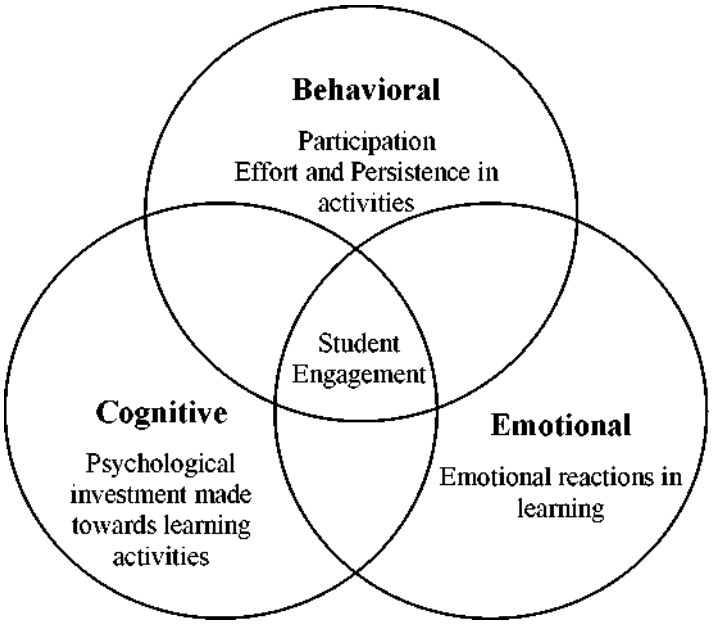


Figure 2.3 Dimensions of Student Engagement

(Source: Nkomo et al., 2021)

The author concludes that the model that incorporates behavioral, emotional, and cognitive dimensions of student engagement offers a comprehensive framework for understanding students' experiences in learning environments. By addressing these three key areas, educators can better support students' active participation, emotional connection, and mental investment in their studies. This approach is especially valuable in online learning, where fostering student interest and involvement is crucial for academic success. Encouraging all forms of engagement not only enhances individual learning outcomes but also creates a positive environment that benefits the entire learning community. However, while the model is holistic in its coverage of engagement dimensions, it does not fully integrate the role of collaborative technology an increasingly important factor in modern online education. The absence of this element may limit the model's effectiveness in capturing how digital tools support peer interaction, shared learning, and active participation in virtual spaces. Ultimately, using this model helps teachers meet diverse student needs and promotes both academic achievement and personal growth, but further enhancement is needed to reflect the technological realities of today's learning environments.

2.10.2 Academic communities of Engagement (ACE)

The second framework explored in this research offers another perspective on how student engagement can be understood and supported by different factors in online learning environments. The Academic Communities of Engagement framework was created to identify the critical factors that help with students' ability to engage in online learning environments. It involves three dimensions of student engagement, which are behavioral, emotional, and cognitive engagement (Borup et al., 2023). The author thinks that, in online or blended learning, students often work on their own without help from others. However, most research focuses on in-person learning and does not examine what helps or hinders learning online, the challenges of engagement remain. These challenges may be why more students drop out of online courses. If students struggle to stay motivated, manage their behavior, or understand the material on their own, they need help from others to succeed. The ACE framework is shown in Figure 2.4.

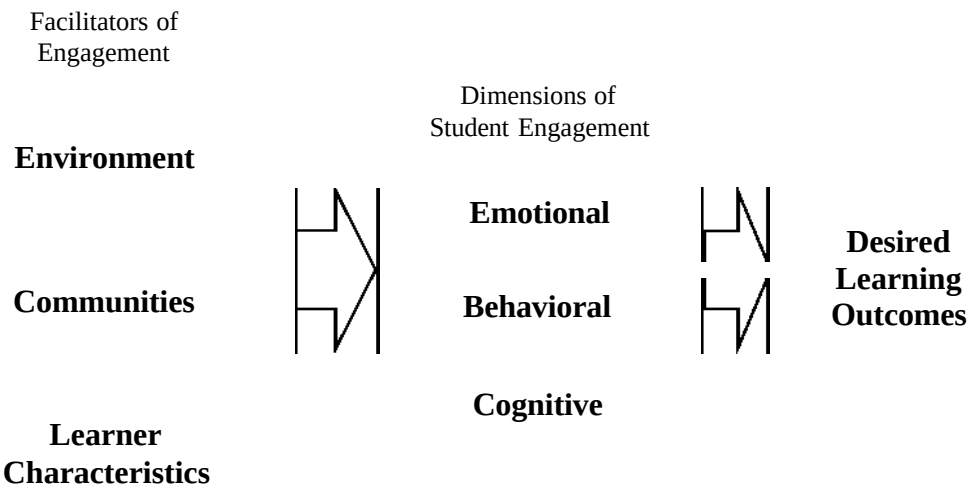


Figure 2.4 ACE Framework

(Source: Borup et al., 2023)

Based on the review, the author believes that the academic communities' framework offers a valuable structure for understanding the key factors that influence student engagement in online learning environments. By focusing on behavioral, emotional, and cognitive engagement, the framework highlights how students interact with content, manage their learning, and connect emotionally to the learning process.

Unlike traditional classroom settings, online and blended learning often require students to work independently, which can lead to feelings of isolation and difficulty staying motivated. The lack of real-time interaction and peer support can make it harder for students to regulate their behaviour and fully understand the material. These challenges contribute to higher dropout rates in online courses. However, despite its usefulness, the framework does not integrate collaborative technology, which plays a critical role in enhancing interaction, communication, and shared learning in online settings. Therefore, to support student success in online learning, it is essential to recognize these engagement challenges and incorporate collaborative tools and strategies that help students stay connected, engaged, and supported throughout their learning journey.

2.10.3 Kahu and Nelson's Model

The third framework explored in this research provides additional insights into how student engagement can be effectively measured and supported, particularly in online learning contexts. The Kahu and Nelson model, also known as the student engagement in the educational interface that came up with a framework for understanding how students engage in their learning at higher education (Clarke & Zhao, 2023). This model views student engagement as a complex process that is influenced by individuals and other factors. Plus, this model recognizes the various forms of student engagement that comprise the dimension of student engagement. This model is used to bring insight for better understanding and enhance students' academic success in higher education (Trowler et al., 2021). The Kahu and Nelson model is shown in Figure 2.5.

One of the key strengths of this model is its acknowledgement of the complex and evolving nature of student engagement (Baker et al., 2024). It includes the three widely accepted dimensions of engagement: behavioral, emotional, and cognitive, while also considering how these dimensions interact within the broader educational context. Rather than viewing engagement as a static outcome, the model highlights how it develops through students' interactions with their environment over time. Importantly, the Kahu and Nelson model serves as both an explanatory and a practical tool. It provides insight into how different factors, such as students' sense of belonging, relationships with teachers and peers, and access to learning resources, can enhance or hinder engagement. By identifying these influences, the model helps educators and

institutions design more effective strategies to improve student engagement and, ultimately, support academic achievement and student success.

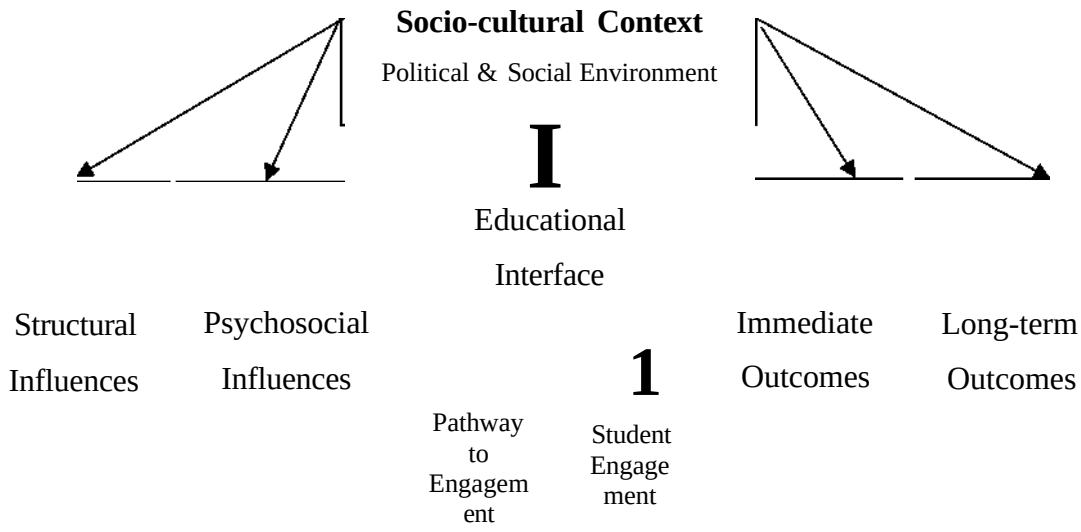


Figure 2.5 Kahu and Nelson model

(Source: Trawler et al., 2021)

After exploring the model, the author of this research concludes that the Kahu and Nelson model offers a valuable and comprehensive framework for understanding student engagement, particularly within online contexts. By recognizing engagement as a complex, evolving process shaped by both individual characteristics and environmental influences, the model moves beyond a simplistic understanding and reflects the dynamic nature of learning. It incorporates the three core dimensions of engagement behavioral, emotional, and cognitive, while also emphasizing how these dimensions interact within broader institutional and personal contexts. This holistic perspective supports the development of more effective strategies to enhance students' sense of belonging, motivation, and academic achievement. However, despite its strengths, the model does not integrate the role of collaborative technology, which is increasingly central to modern online learning environments. The absence of this component may limit its applicability in digital contexts where peer interaction, shared tasks, and real-time collaboration play a significant role in fostering engagement. Therefore, while the model is a strong foundation for understanding student engagement, future adaptations could benefit from incorporating collaborative

technological elements to more accurately reflect current educational practices and needs.

2.10.4 Community of Inquiry (CoI)

The fourth framework explored in this research provides an additional lens for understanding student engagement, focusing on the broader educational factors that influence how students connect with their learning. The Community of Inquiry (CoI) framework is a way to improve learning, especially online, by combining social interaction, thinking, and teaching (Martin & Carolina, 2022). It focuses on people learning together by discussing ideas, thinking deeply, and building understanding as a group. The CoI framework says that social, thinking, and teaching parts of learning all work together and affect how well people learn (Rahmatalla et al., 2024). When students feel connected to others (social presence), they are more willing to think and explore ideas (cognitive presence). Good teaching helps guide learning and brings everything together. This way of learning works in online, mixed, and face-to-face classes. CoI framework is shown in Figure 2.6.

The framework offers a broader perspective on student engagement by emphasizing the collective and interactive aspects of the learning process. Known as the Community of Inquiry (CoI) framework, this model is widely used to enhance educational experiences, particularly in online learning environments, by integrating three key elements: social presence, cognitive presence, and teaching presence (Carroll et al., 2025). Carroll also stated that these components work together to create a supportive and collaborative learning environment where students not only absorb content but also actively engage in meaning-making through interaction and reflection. The social presence aspect of the CoI framework highlights the importance of building personal connections among learners. When students feel a sense of community and emotional connection with peers, they are more likely to engage in open discussions and share their ideas (Tabassum et al., 2024).

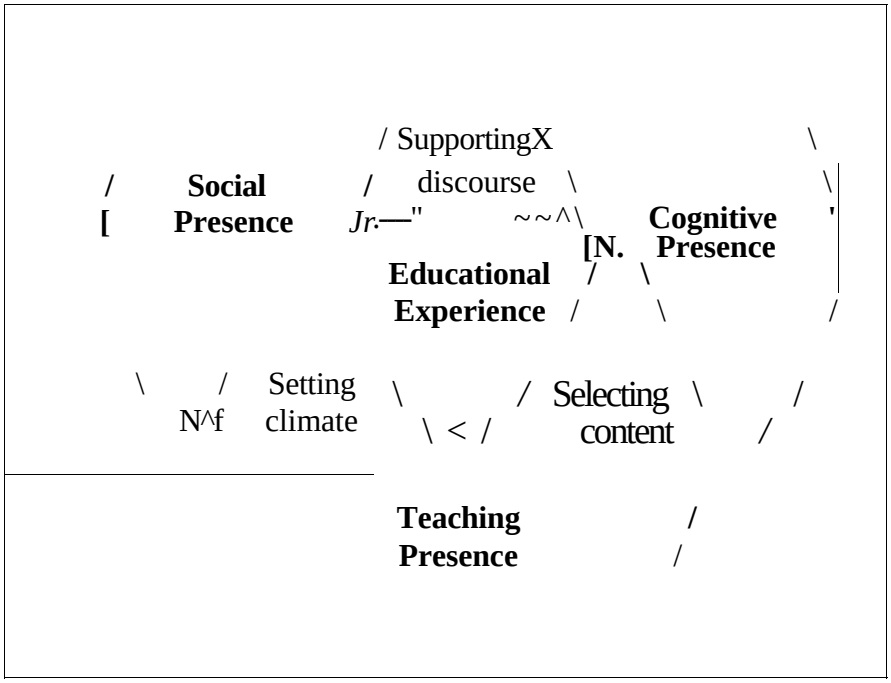


Figure 2.6 Community of Inquiry (Col) framework

(Source: Rahmatalla et al, 2024)

By viewing learning as a shared process, the author believes that the Col framework provides valuable insights into how engagement can be fostered not only through individual motivation but also through group interaction and structured facilitation. It is applicable across various learning environments, including fully online, blended, and traditional face-to-face classrooms. However, despite its emphasis on collaboration, the framework does not explicitly integrate the use of collaborative technology, which is increasingly essential in shaping interaction and engagement in digital learning spaces. Overall, the Col framework emphasizes that meaningful engagement emerges when students feel socially connected, cognitively challenged, and well-supported by effective teaching.

2.10.5 Social Presence Model Theory

The fifth framework explored in this research is Social Presence Theory, one of the most commonly applied theories in online learning environments. Social presence theory is one of the existing theories that is mostly used when it comes to the online learning environment and was first invented by Short in 1976. According to Short et al., (1976) social presence is defined as "the degree of salience of the other person in the

interaction and the consequent salience of the interpersonal relationship" (p.65). That means the point at which a person is perceived as a real person in virtual communication. Besides, they define social presence as a quality of the medium itself and conclude that communications media vary in their degree of social presence, and these variations are important in determining the way a person interacts (Gunawardena, 1995). Another definition of social presence by Garrison, Anderson and Archer (2000) is the ability of participants in a community of inquiry to project themselves socially, emotionally as real people through the medium of communication being used. In addition, social presence can be referred to as the sense of being with one another in an online interface (M. Ali et al., 2022).

According to Ali et al., (2022), social presence theory states that computer-based communication is lower in social presence as compared to face-to-face communication, which means online learning brings less sense of social presence to the students. However, there is an argument saying that in an online learning context, social presence depends on three dimensions, which are social context, online communication, and interactivity, as shown in Figure 2.7 that means if the environment assists the process of learning in a social context and involves interactivity, the students can feel the social presence. It can be used as a guidance and reference to develop an effective online learning interaction decades ago (Dahlstrom-hakki, 2020; Bali et al., 2024).

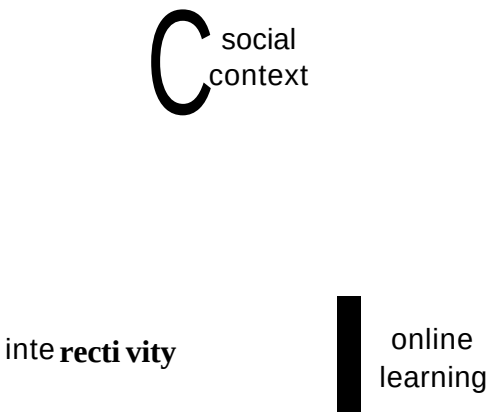


Figure 2.7 Dimensions of Social Presence

(Source: Sandell, 2023)

The influence of social presence may help in explaining how student behaviours are affected by technology characteristics, since collaborative tools can be used for asynchronous interactions, and some other tools are no different from face-to-face interactions. Interactions not only relate to active learning but are also found to be related to engagement (Qureshi et al., 2021; Lasekan et al., 2024). Furthermore, social presence theory perceives the critical role of social learning and relationships on student engagement in online learning. Plus, it addresses concerns towards online transactional that are experienced by students, for example, they find it challenging to make them feel like a recognized person as opposed to an anonymous member (Lowenthal & Dunlap, 2020; Bait, 2023). The same author also suggests that social learning is able to help in building relationships with others in an online environment, especially when involved with asynchronous interaction, communication, and collaboration technologies such as asynchronous online discussion. Moreover, the feeling of isolation and loneliness is the reason why students do not persist in online learning (Kreijns et al., 2022). However, previous literature has suggested that social presence can help to address students' feelings of isolation and loneliness in online classrooms, besides improving students' retention in online courses (Lowenthal & Dunlap, 2020; Li, 2022).

Social presence is considered a critical component that becomes a need to foster social interaction for online learning environments (Alanazi, 2019a). A previous study revealed that social presence found can be a prediction of student retention and helps them to improve students' interaction that can positively influence their performance in learning (Mathews & Basco, 2020). Basically, social presence usually involves contact between a group of people through online tools such as emails, text messages, and online announcement boards. Besides, students' engagement is one of the techniques that can be used for online teaching and learning to enhance social presence and students' retention for an online learning environment (Alenezi, 2022). Plus, the author mentioned that research on social presence found that in virtual learning, students' emotional connections are essential as it is becoming a significant determinant of students' satisfaction and perceived learning through online environments.

Table 2.7
The gap in existing frameworks and models explored

Frameworks/Models	Description	Gap
Student engagement model by Nkomo	Offers complete framework to understand student engagement by three-dimensional of student engagement	Lack of technology integration
Academic Communities of Engagement (ACE)	Examines student engagement by three-dimensional of student engagement. Also, it highlights other factors that support enhance online learning.	Lack the elements of collaborative technology which is important for online interaction
Kahu and Nelson's Model	View student engagement as complex process that influence by multiple factors	Does not include collaborative technology that limit its relevance in online learning
Community of Inquiry (Col)	Focus on student engagement through the factor of social, cognitive and teaching factors	Does not include collaborative technology element which is crucial for online engagement
Social Presence Theory	Highlights how student perceive their peers as 'real' to create the sense of 'being together' in online mode	Lack integration of collaborative technology makes it limited to its relevance for

online learning environment

After all, it can be inferred that Social Presence Theory provides a foundational framework for understanding how learners perceive and engage with one another in online learning environments. It emphasizes the importance of creating a sense of real human presence through mediated communication, which plays a crucial role in reducing feelings of isolation and promoting emotional connection among learners. As explored, social presence enhances not only interpersonal interaction but also contributes to increased student satisfaction, engagement, and retention in online courses. The theory highlights the importance of three key elements—social context, communication, and interactivity in fostering meaningful online experiences. Moreover, it recognizes that the design and use of digital platforms significantly influence the level of perceived presence and student engagement. While Social Presence Theory effectively addresses the interpersonal and emotional aspects of online learning, it does not fully integrate collaborative technology tools, which are essential for promoting asynchronous and synchronous interactions in today's digital classrooms. Therefore, future adaptations of the framework could benefit from including the technological dimension to better reflect the current landscape of online education and further support meaningful student engagement.

Further exploration into the specific elements of social presence is essential to deepen our understanding of how these components influence student engagement and learning outcomes in virtual environments.

2.11 Elements of Social Presence Theory

Online learning allows teachers and students to interact with each other flexibly using collaborative technologies, but the quality of the communication and interaction between them could be influenced by social presence. According to the original social presence elements, there are only three indicators of social presence, which are affect, cohesion, and interaction. But after years, another two (2) important elements that affect social presence were added, which are participants' knowledge and experience, and instructor involvement (Whiteside, 2015). As the new integrated elements consist of

five items, which are affective association, community cohesion, instructor involvement, interaction intensity, and knowledge and experience that all of them affect students' motivation to become an active role in their own and with peers in learning. For the best understanding, the social presence model is illustrated in Figure 2.3 (Whiteside, 2007).

According to A. Whiteside (2015), the first item, which is Affective Association, refers to "emotional connections which occur within the session". For example, instances of emotion and self-disclosure to personal emotion. Another example is all caps, font style, emoticons, or emojis to express their emotions. Next item is Community cohesion, which refers to the course community, which includes sharing additional resources and information with peers through the act of togetherness. For example, greetings, salutations, and vocatives, as well as sharing information with others. The third item in the social presence model is Instructor Involvement. According to previous research, most students mentioned involvement of instructors or teachers was essential to them in making social connections online. Besides, it is found to be crucial for teachers to push their students in order to engage them and affirm higher-order thinking skills in an online environment. An example of a situation is teachers giving feedback to the students on their work. The next item is Interaction Intensity, which refers to the level of interaction between students and their peers. For example, the students express what they feel to their peers and a kind of acknowledgement, such as "I can understand the way you explain things". Another example is agreement, disagreement, compliments, and questions. Finally, there is Knowledge and Experience, which is knowledge and experience that play an important role in building social presence. Without the knowledge to share and the willingness to share, the connection will reduce, and the level of social presence will also decrease. Overall, all these integrated elements assist teachers and students in problem-solving and become important tools for the current and next research as well (A. Whiteside, 2015). The elements of social presence theory as shown in Figure 2.8.

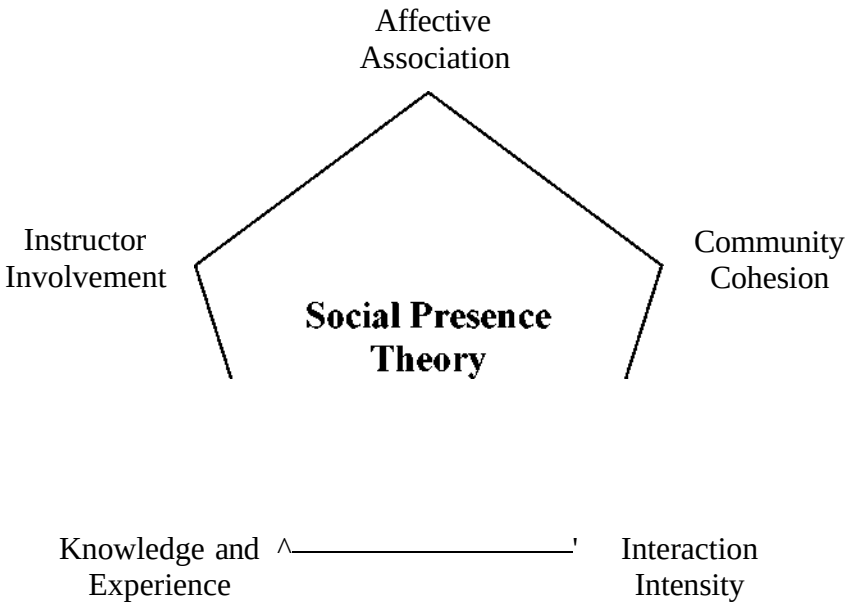


Figure 2.8 Social Presence Theory

(Source: A. Whiteside 2015)

A study by Alenezi (2022) mentioned that interaction alone does not characterize the students' social presence, as it needs to be measured using relational presence together with the ability to establish connections in order to sustain meaningful student engagement. The first one is social interaction (SI) that refers to "the interaction that happens between students and teachers when implementing strategies to foster interpersonal encouragement and social inclusion". Secondly, social space (SS) is the connections among members, including rules and responsibilities, grouping values, beliefs, and aspirations. Besides, it can be beneficial for interpersonal relationships in the group, such as group cohesiveness, respect, trust, and belonging. Thirdly, social identity (SID) refers to a person's self-concept or self-categorization as a member of several groups or classes. Next, social influence (SIN) refers to a process in which the presence or activity influences students' beliefs, attitudes, or conduct that consists of compliance, obedience, conformity, and minority influence. Finally, social support (SSP) refers to an activity in which a person experiences, perceives, and expresses emotional concern, instrumental help, or knowledge through human interaction. In short, it can be described as the interaction with others that provides students with insight for their good learning experience.

The expanded dimensions of Social Presence Theory, namely social interaction, social space, social identity, social influence, and social support, highlight the multifaceted nature of presence in online learning environments (Sun, 2024). Each of these elements plays a distinct yet interconnected role in fostering students' sense of connection, inclusion, and emotional involvement during virtual learning sessions. When students feel socially present, they are more likely to engage meaningfully with peers and instructors, remain motivated, and participate actively in discussions, all of which contribute to improved learning outcomes. Each of five items in social presence theory brings different types of connection that assist online learning environment to be felt the presence during the session in which will influence the improvement of student engagement. However, while the framework effectively addresses interpersonal and emotional dynamics, it does not explicitly integrate collaborative technology, which plays a critical role in facilitating real-time interaction, group work, and knowledge sharing in modern online education. Therefore, a comprehensive approach to measuring social presence should include both relational dimensions and the role of collaborative tools to ensure a deeper insight into how students experience and sustain engagement. This holistic understanding is essential for designing effective online learning strategies that promote student success and long-term retention.

2.12 Other Factors of Student Engagement

After the exploration of the existing framework and model of key dimensions of student engagement, there are also various factors that influence and promote students' active involvement in the learning process. Sokmen (2021) stated that student engagement can be influenced by both student and teacher factors. Besides, several studies found that student engagement can be influenced by demographic characteristics such as age, digital literacy, and educational background. As well, how educational institutions design their learning environment also affects student engagement in their learning (Nkomo et al., 2021). Past literature in the study by Salayo et al., (2021) stated that the essential factors of successful student engagement in an online learning environment are formal and informal community, time management and organization skills, engaging and supportive online teachers, multiple means of interaction, opportunities for skill development, confidence building, and self-regulation. However, Chiu (2021) concisely mentioned in the study that student engagement is energized by

motivation and fostered by various contextual factors such as teachers, peers, and environmental support.

Several studies have shown that students' learning experiences in online learning are influenced by many factors, including the detached and non-interactive nature of learning, lack of concentration, and more. These factors can significantly impact students' learning outcomes, and in an online learning context, student engagement factors relate to cognitive (mental involvement), behavioral (active participation), and emotional (effective connection) engagement. Also, sociocultural factors impact students' feelings, attitudes, values, thoughts, and beliefs during teaching and learning activities (Fang et al., 2023). A study by Istijanto & Nathalie (2024) mentioned that several factors that influence students' engagement are personality characteristics, supportive learning resources, teacher-student relationship, teacher behavior, learning behavior, environmental support, and learning-thinking ability. However, there are several factors that can motivate them in learning, which is learning effectiveness, flexibility, social interaction, campus life experience, physical wellness, technological learning, efficiency, and a great attitude.

Five main factors are found by Hou (2023) include students, teachers, learning resources, learning platform and learning evaluation. Mainly, the factors of students' learning participation include teaching environment, number of online courses, learning platform, learning terminals, learning hours, online learning participation, needs for answering questions, and offline participation. According to a study by Osman et al., (2024), factors that affect student engagement are student satisfaction, service quality, motivation, satisfaction, trust, and commitment. Another study by Wang (2024), factors that influence student engagement is students' self-regulation skills that are effective in transforming learning tasks affects the level of student engagement. However, the author also found that student attention, peer feedback, teacher-student interaction, and teaching mode can also influence student engagement. The summary of the factors in student engagement model is briefly explained in Table 2.8 regarding the factors that are found from past literatures.

Table 2.8
The Factors of Student Engagement

Factors of Student Engagement	Citation
Student engagement can be influenced by both student and teacher factors.	Sokmen (2021)
Student engagement can be influenced by demographic characteristics such as age, digital literacy, and educational background, how educational institutions design their learning environment	Nkomo et al., (2021)
Essential factors are formal and informal community, time management and organization skills, engaging and supportive online teachers, multiple means of interaction, opportunities for skill development, confidence building, and self-regulation.	Salayo et al., (2021)
Student engagement is energized by motivation and fostered by various contextual factors such as teachers, peers, and environmental support	Chiu (2021)
The detached and non-interactive nature of learning, lack of concentration, and sociocultural factors also impact students' feelings, attitudes, values, thoughts, and beliefs during teaching and learning activities	Fang et al., (2023)
Several factors that influence students' engagement are personality characteristics, supportive learning resources, teacher-student relationship, teacher behavior, learning behavior, environmental support, and learning-thinking ability	Istijanto & Nathalie (2024)
The factors include students, teachers, learning resources, learning platform, and learning evaluation	Hou (2023)
Factors that affect student engagement are student satisfaction, service quality, motivation, satisfaction, trust, and commitment.	Osman et al., (2024)
Factors that influence student engagement are students' self-regulation skills, student attention, peer feedback, teacher-student interaction, and teaching mode	Wang (2024)

This review finds that after done the exploration of existing frameworks and models with other factors, it is revealed that student engagement is a multifaceted phenomenon influenced by a wide range of factors. These factors include characteristics of both students and teachers, demographic variables, and the design of the learning environment. Additionally, motivation, social interactions, and contextual supports play crucial roles in fostering engagement. Research consistently highlights that cognitive, behavioral, and emotional dimensions of engagement are impacted by various personal, social, and institutional elements, such as self-regulation, teacher support, learning resources, and technological tools. Understanding these diverse influences is essential for educators and institutions aiming to enhance student involvement, especially in online learning settings where unique challenges exist. However, while these factors

provide valuable insight, further integration of collaborative technology as a motivating and facilitating element remains an area for future exploration to fully support and sustain student engagement.

2.13 Chapter Summary

In summary, collaborative technology, collaborative learning, and student engagement are closely connected elements that play a vital role in ensuring the quality of online teaching and learning. Social Presence Theory, which emphasizes the connection between teachers and students, serves as a useful framework for guiding data analysis in this area. It is widely understood that the more effort and engagement students invest in learning activities, the more effective the learning process becomes. Collaborative tools have been shown to help teachers address challenges related to student engagement and improve cooperation during learning. Additionally, the success of online learning depends on several factors, including active participation, effective administration, access to multimedia technology, suitable classroom conditions, technical skills, and policy support. Among these, active learning is especially important because it motivates students and encourages their active involvement in online activities.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodology used to conduct this research. It focuses on three main objectives: first, to explore existing frameworks and models of student engagement in relation to collaborative technology; second, to design a student engagement model that incorporates collaborative technology; and third, to validate the proposed model. The first objectives have been achieved in the previous chapter. In order to achieve these aims, this chapter details the overall research design, sampling techniques, research instruments, data collection procedures, and methods of data analysis. Each section is structured to ensure that the research process is systematic, reliable, and aligned with the research objectives.

3.2 Research Design and Procedure

In academic research, there are typically three main research designs that can be chosen from: quantitative, qualitative, and mixed-methods (Newaz, 2022). Each of these approaches has its strengths and is selected based on the nature of the research and the type of data required. For this research, a quantitative research design was chosen because the main objective is to collect data in numerical form that can be measured and analyzed statistically to answer specific research questions related to student engagement in online learning environments. The quantitative approach is widely used when researchers aim to collect data from a large number of participants and identify patterns or relationships between variables (Ghanad, 2023). One common way to do this is by conducting surveys using structured questionnaires (Kittur, 2023). These questionnaires allow researchers to gather consistent and reliable data across participants, which can then be analyzed using statistical software such as SPSS to draw meaningful conclusions (A. Ali, 2021; Abdullah, 2025).

In this research, the survey was conducted in several randomly selected schools across different areas in Kelantan, covering various geographic points such as the north, south, east, and west. This method of sampling was chosen to ensure diversity in the

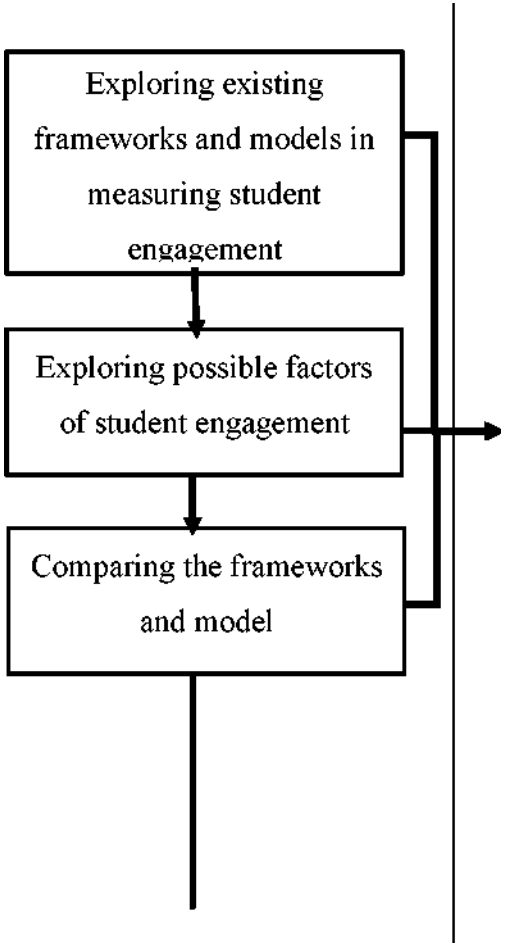
student population and to increase the number of responses. By reaching students from different locations, the research aims to gain a broader understanding of how students in Kelantan engage with collaborative technology in online learning. The main purpose of the data collection process is to measure the level of student engagement during online learning sessions, particularly when using collaborative tools. The engagement is assessed based on the three main dimensions of student engagement: behavioral, emotional, and cognitive. These dimensions provide a comprehensive view of how students interact with content, show interest, and apply thinking strategies during the learning process.

To ensure the accuracy and validity of the instrument, the questionnaire used in this research was adapted from previous studies that measured student engagement in online learning contexts (Alanazi, 2019; Mekki et al., 2022; Mwita et al., 2015; Okwuduba et al., 2022). These sources served as references to construct relevant and reliable items aligned with the research objectives. By using this approach, the research aims to provide evidence-based findings that can inform how collaborative technologies influence student engagement with the elements of social presence in digital learning environments.

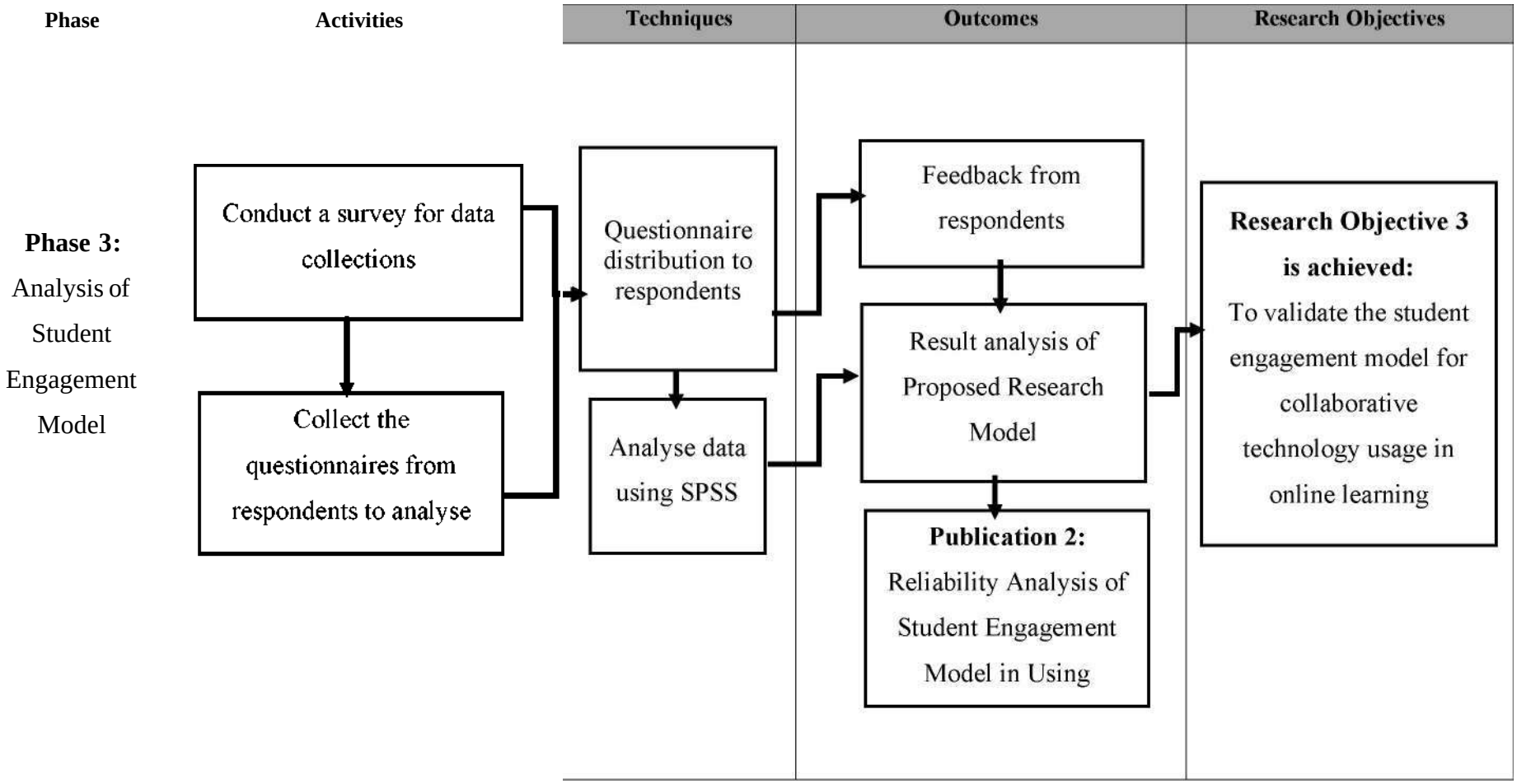
3.3 Research Framework

A research framework is developed to provide a clear understanding of the overall research process and how it will be carried out. This framework must be carefully planned to ensure that each phase achieves its intended outcomes. To better visualize the steps taken in developing the student engagement model, the author illustrates a table outlining the flow of research activities. Figure 3.1 to Figure 3.5 illustrates how the research was conducted, including the methods and tools used at each phase, as well as the expected outcomes. This structured approach helps ensure that all research questions and research objectives are systematically addressed throughout the process.

Phase	Activities	Techniques	Outcomes	Research Objectives
Phase 1: Problem Formulation	Literature review on: What are the current issues and challenges in online learning? How past researchers find the online (process, methods, model, data Identify research objectives Identify research objectives	Analysis of literature findings	Possible problems of Online Learning: Sustaining student engagement Research questions are identified. Research objectives are identified.	

Phase	Activities	Techniques	Outcomes	Research Objectives
Phase 2: Development of Student Enngagement Model		Analysis of literature findings	Possible models related to the study are identified: 1. Student Engagement Model 2. ACE framework 3. Kahu & Nelson 4. CoI 5. Social Presence Theory Selected existing frameworks and model: Social Presence Theory and Student Engagement Model	**Research Objective 1 is achieved:** To explore the existing models for collaborative technology usage in online learning.

Phase	Activities	Techniques	Outcomes	Research Objectives
Phase 2: Development of Student Engagement Model	Proposed a Research Model based on existing frameworks and factors that ag Prepare questionnaire based on proposed Research Model.		Research Model is proposed. A set of Questionnaire is obtained. **Publication 1:** Reconstruction of Student Engagement Model for Collaborative Technology	**Research Objective 2 is achieved:** To design a student engagement model for collaborative


Phase
Activities
Techniques
Outcomes
Research Objectives
Phase 3:
Analysis of
Student
Engagement
Model
Conduct a survey for data collections
Collect the questionnaires from respondents to analyse
Questionnaire distribution to respondents
Analyse data using SPSS
Feedback from respondents
Result analysis of Proposed Research Model
Publication 2:
Reliability Analysis of Student Engagement Model in Using
Research Objective 3 is achieved:
To validate the student engagement model for collaborative technology usage in online learning

Phase	Activities	Techniques	Outcomes	Research Objectives
Phase 4: Thesis Writing	Thesis writing	Compile the findings	Completed thesis	

Following the explanation of the research flow, the next section presents a detailed discussion on the reconstruction of the student engagement model, which involves refining and adapting the key components and dimensions identified from existing literature, frameworks, and empirical data to develop a more comprehensive and contextually relevant model that integrates collaborative technology for enhancing engagement in online learning environments.

3.4 Development of Enhanced Student Engagement Model

This section reveals the development of the enhanced student engagement model, which is a crucial part of this research. It builds upon the findings gathered from the review of existing frameworks, models, and factors influencing engagement, as well as the gaps identified, particularly the lack of integration of collaborative technology in current models. The purpose of this reconstruction is to design a model that not only reflects the core dimensions of student engagement, behavioral, emotional, and cognitive, with opportunities of online learning environments. By incorporating collaborative technology as a key component, this model aims to offer a more relevant and practical approach for understanding and measuring how students engage in online learning settings. This reconstructed model serves as the foundation for further data collection, analysis, and validation in the subsequent stages of the research, making sure it is based on strong theory and can be used effectively in real teaching and learning situations.

Explain in detail, after examining previous literature of existing frameworks and models related to student engagement, the author believes that there is a lack of a technology component to assess student engagement in an online learning context. Most of the existing models focus on the core dimensions of engagement behavioral, emotional, and cognitive, but do not fully consider how technology, particularly collaborative tools, impacts student engagement (Nkomo et al., 2021b; Martin & Carolina, 2022; Borup et al., 2023; Sandell, 2023; Baker et al., 2024). In today's digital learning environments, technology is not just a supporting tool but a central part of how students learn, interact, and participate. However, many existing frameworks as has been explored in chapter 2, were developed with traditional, face-to-face settings and may not fully capture the unique challenges and opportunities of online learning. For example, previous researchers have often overlooked how collaborative tools like

discussion forums, shared documents, video conferencing platforms, or other digital collaborative technologies contribute to or hinder engagement.

As a result, there is a gap in the literature when it comes to understanding how students engage through digital platforms. This shows the need for more updated or enhanced models that integrate the role of technology, particularly collaborative technologies, in shaping student engagement in online education. It is important to highlight that the author has explored, analyzed, and conducted literature analysis to reconstruct the student engagement model. Therefore, the author of this research adds a variable of collaborative technology that consists of social presence elements for measuring student engagement. There will be independent and dependent variables of the model. The author discovered several elements to be used in the model and additional variables to complete the model.

3.4.1 Collaborative Technology

To begin the explanation of the proposed student engagement model, this section outlines the independent variables that influence student engagement. The first independent variable is collaborative technology, which plays an important role in the model for the online learning context. Collaborative technology is one of the independent variables in the student engagement proposed model. This variable consists of two elements of social presence theory that are related to be used for collaborative technology. First is community cohesion, which refers to greetings and sharing various resources of information with peers and other participants. The second element is knowledge and experience, which means the prior knowledge and experience of using collaborative technology by students to bring the connection in online learning for them to master the course they learned.

The items of collaborative technology are considered important because they directly support two key elements of social presence theory, which are crucial for student engagement in online learning environments. Community cohesion involves greetings, interaction, and sharing of resources among students and participants. These actions are technology-dependent in online learning environments, and without collaborative tools for example, discussion forums, video conferencing, and shared documents, students cannot easily build social bonds. Thus, the importance of collaborative technology lies in its role as a bridge for fostering a sense of community,

which in turn enhances engagement. Hence, students' prior knowledge and experience with collaborative tools influence how well they connect in online environments. When students are comfortable and proficient with the technology, they can interact more effectively, share ideas, and collaborate to master course content. Therefore, the effectiveness of online learning is partly dependent on both the availability of collaborative tools and students' ability to use them.

In conclusion, collaborative technology plays a vital role as an independent variable in the proposed student engagement model, particularly within the online learning context. By integrating key elements from social presence theory, community cohesion, and knowledge and experience, this variable emphasizes the importance of building meaningful connections through technology. Collaborative tools act as essential channels for interaction, communication, and resource sharing, helping students feel more connected and involved in the learning process. When students have prior experience and confidence using these tools, they are more likely to participate actively, collaborate effectively, and remain engaged throughout their online learning journey. Therefore, recognizing the impact of collaborative technology not only strengthens the design of online learning environments but also supports students' academic success and overall engagement.

3.4.2 Social Presence Theory Model

To begin the development of the proposed student engagement model, it is essential to identify the theoretical foundations that support its key components. The foundation is Social Presence Theory, which offers valuable insights into how students build connections and engage in online learning environments. Social Presence Theory, which was explored in Chapter 2, has been utilized to support the addition of an independent variable in the proposed model. There are five items in Social Presence Theory (SPT) that perceive the critical role of online learning and are related to student engagement. There are five items of SPT which are Affective Association, Community Cohesion, Instructor Involvement, Interaction Intensity, and Knowledge and Experience. In short, first element which is Affective Association refers to emotional connection, the second item Community Cohesion refers to act of togetherness, the third is Instructor Involvement which refers to the feel of the presence of instructor, the fourth is Interaction Intensity that refers to the level of interaction, and the last elements is

Knowledge and Experience which is important role in building social presence. If the last elements are not involved, the value of social presence will decrease.

As mentioned, there are a few items from SPT that have been split into another independent variable, which is under Collaborative Technology. The items are Community Cohesion and Knowledge and Experience because these two items involve the use of collaborative technology. Besides, the reason for splitting the items is because it is related to the function of collaborative technology, since this research tries to investigate student engagement experience by using collaborative technology in performing online learning, and to see if it affects the students' engagement. So, there are only three items remaining under SPT variables, which are Affective Association, Instructor Involvement, and Interaction Intensity. Social presence theory is a component to fosters social interaction in online learning, and it does affect students' interaction online. Social presence is the key to learners' success and participation in online collaboration, and participation is one of the characteristics of student engagement. As shown in Figure 3.6, the five elements of the social presence model are from past literature review.

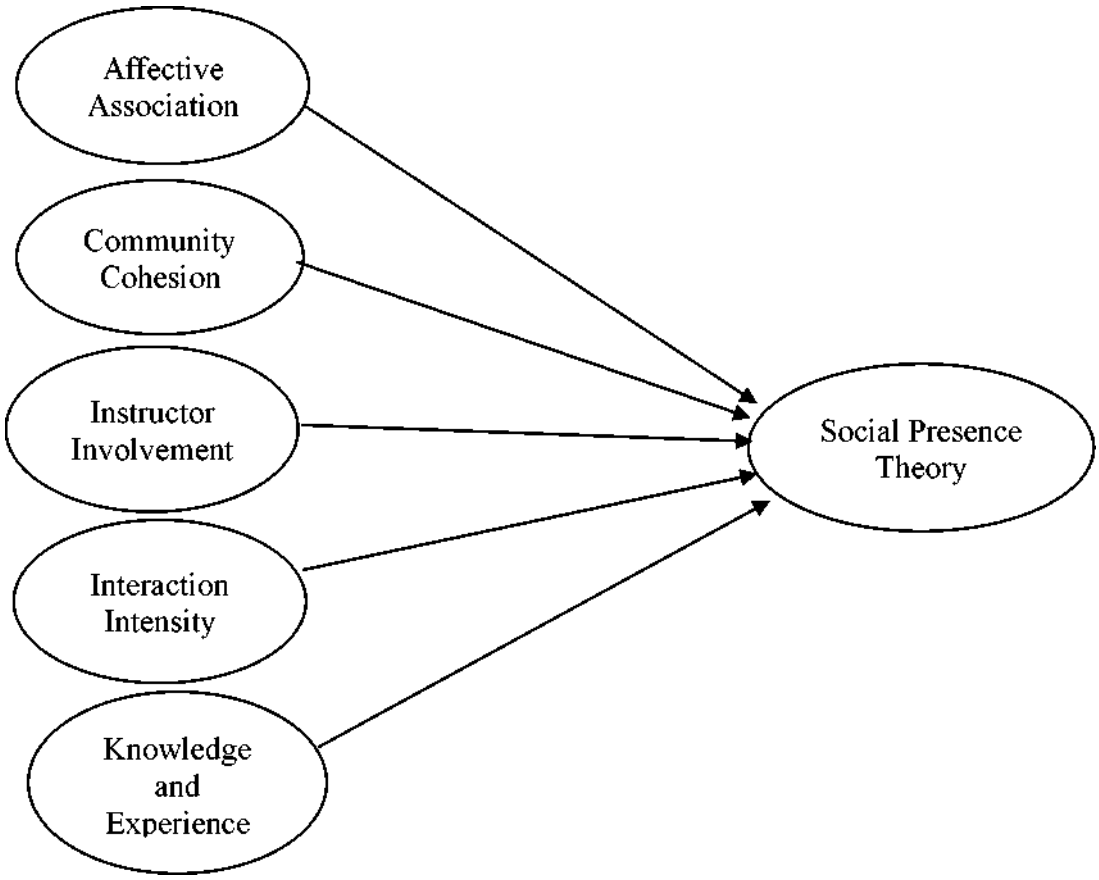


Figure 3.6 Social Presence Theory Model

In summary, Social Presence Theory serves as the core theoretical foundation for developing the proposed student engagement model. This theory helps explain how students form meaningful connections and engage in online learning environments. It includes five key elements: Affective Association, Community Cohesion, Instructor Involvement, Interaction Intensity, and Knowledge and Experience. Each element plays a distinct role in promoting student engagement by fostering emotional connection, group belonging, interaction with instructors, and collaborative learning. To better align with the research focus on collaborative technology, two of the elements, Community Cohesion and Knowledge and Experience, have been placed under a separate independent variable, Collaborative Technology. This adjustment allows the model to specifically examine how the use of technology contributes to student engagement. The remaining three items, Affective Association, Instructor Involvement, and Interaction Intensity, continue to represent the Social Presence variable in the model. By structuring the model, the research aims to more effectively investigate how both social presence and collaborative technologies influence student engagement in online learning contexts. This framework not only supports theoretical grounding but also offers practical relevance for designing effective online learning experiences.

3.4.3 Existing Student Engagement Model

To guide the development of the proposed model, it is useful to revisit the three dimensions of student engagement presented in the literature review. The previous chapter has explained that there are three dimensions of student engagement, which are Behavioral, Cognitive, and Emotional engagement. According to the literature review in the previous chapter, these three dimensions are most studied and used by previous researchers when it comes to measuring student engagement in an online learning context. The behavioral engagement dimension is described as effort and persistence. Emotional engagement is described as a reaction, and the last dimension, which is Cognitive engagement described as the knowledge. All these dimensions are influenced by many factors.

Therefore, the use of collaborative technology in the teaching and learning process is found to help improve student engagement. Although each of the three dimensions of student engagement is different, there is considerable overlap in the model. Combining the three dimensions can provide a clearer description of students

about their engagement. Therefore, it is important to measure all the dimensions when measuring student engagement because focusing on only one dimension can limit the understanding of student engagement (Kassab SE, El-Sayed W, 2023; Nkomo et al., 2021a). As shown in Figure 3.7, the dimensions of student engagement by previous literature, which helps in understanding the relation between all the dimensions of student engagement.

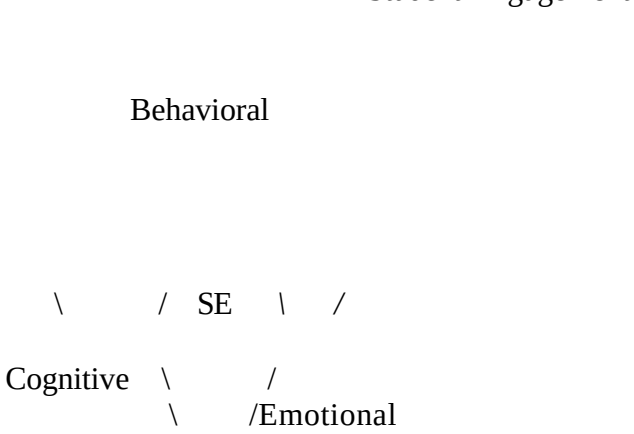


Figure 3.7 Dimensions of Student Engagement

In conclusion, the three dimensions of student engagement, behavioral, cognitive, and emotional, form a strong foundation for developing the proposed model. These dimensions have been widely used in past research to assess engagement in online learning contexts, offering valuable insights into students' efforts, reactions, and understanding during the learning process. While each dimension represents a different aspect of engagement, they are closely connected and often overlap in practice. This interconnection highlights the importance of examining all three dimensions together, as focusing on just one may result in an incomplete view of student engagement. Integrating collaborative technology into the teaching and learning process has been shown to positively influence all three areas, enhancing overall student involvement. Therefore, a complete model that includes these three dimensions together with the use of suitable technology gives a clearer and more complete understanding of how students stay engaged in online learning. The next section will discuss more about the model.

3.4.4 Proposed Student Engagement Model

The proposed model includes all the variables explained above, as the Social Presence and Collaborative Technology are the independent variables, and Student Engagement is something that this research has investigated, therefore, it becomes the dependent variable. In short, for Collaborative Technology variables, there are two items, which are Community Cohesion and Knowledge and Experience. For Social Presence, there are three items which are Affective Association, Instructor Involvement, and Interaction Intensity. Items for dependent variables are the dimensions of Student Engagement that consist of three elements, which are Behavioral, Cognitive, and Emotional. By the construct of the proposed model, it becomes the foundation to develop a questionnaire to get feedback from students on their interactions and perceptions of using collaborative technologies in an online learning environment to measure their engagement experience towards teaching and learning sessions.

This research model is constructed according to factors that influence student engagement based on the elements of social presence and the use of collaborative technology in an online learning environment. As mentioned before, this model adopts all the elements of social presence theory as the independent variables, but there are two items that were split under another independent variable, which is collaborative technology, since it is related to the scope of technology. The model for this research is formed as shown in Figure 3.8, as it describes the connection between independent and dependent variables that represents the research model used to investigate student engagement towards the use of collaborative technologies for the online learning context. Furthermore, each of the items in the model is used to construct questionnaires in order to make a survey for this research as the instrument to explore the student engagement. Plus, this research uses the proposed model to measure student engagement in all different dimensions since each of the dimension represent different characteristics of engagement.

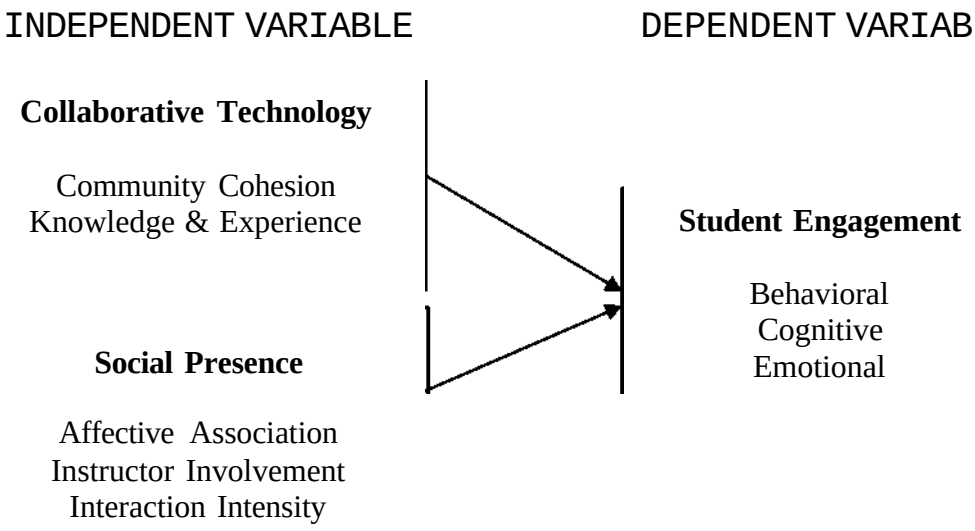


Figure 3.8 Proposed Student Engagement Model

In conclusion, the proposed research model brings together key elements from both Social Presence Theory and collaborative technology to better understand and measure student engagement in online learning environments. Social Presence and Collaborative Technology serve as the independent variables, while Student Engagement, divided into behavioral, cognitive, and emotional dimensions, is the dependent variable. Specifically, the model includes two items under Collaborative Technology (Community Cohesion and Knowledge and Experience) and three items under Social Presence (Affective Association, Instructor Involvement, and Interaction Intensity). This structure helps provide a clear foundation for developing a questionnaire to gather students' feedback on their experiences and interactions with collaborative tools during online learning sessions. The model offers a focused way to explore how these tools impact student engagement. By aligning the model with the core elements of student engagement and integrating relevant technological factors, this research not only helps explain how students participate in online learning but also supports the development of more effective digital teaching strategies. The proposed model, as shown in Figure 3.8, serves as a practical guide for both data collection and analysis in assessing student engagement within the context of collaborative online education.

3.5 Data Collection

This section outlines the methods and procedures used to gather and interpret data for this research. It begins by explaining the approach taken to collect relevant information from participants, including the selection of respondents, the instruments used, and the steps followed during the data gathering process. This section also describes how the collected data were analyzed to draw meaningful conclusions related to student engagement and the use of collaborative technologies with social presence elements in online learning. The aim is to ensure that the research findings are accurate, reliable, and aligned with the objectives of the research.

3.5.1 Sources of Data

Based on a study by Rezeki et al., (2022), there are two types of data in conducting data collection, which are primary and secondary data. Data that has been collected for this research is primary data in which the raw data has been collected manually by the author in randomly selected schools based on cardinal points in Kelantan by using questionnaires as the instrument.

3.5.2 Sample Size

After reviewing the previous research on technology integration in the online learning context, Table 3.2 summarizes the type of sampling, size of sample, and how past researchers analyzed the data for their data analysis. This research conducted data collection based on how previous researchers conduct their study, as cited in the table on the use of technology in teaching and learning sessions, as the references. According to Table 3.1, it can be concluded that the range of sample size is from 300 to 500 students.

Table 3.1
Sampling and Data Analysis from Previous Literature

Author, year	Sample size, N	Statistical software
Behavioural intentions of using virtual reality in learning- perspectives of acceptance of information technology and learning style (Shenetal., 2019)	N== 387	SPSS and AMOS 22
Investigating the Role of Educational Media on Secondary School Students' Learning Process Improvement in Jahrom City (Eslami & Ahmadi, 2019)	N== 350	SPSS
Attitude Prediction towards ICT and Mobile Technology for the Real- Time- An Experimental Study using Machine Learning (Velicanuetal., 2019)	N== 331	SPSS IBM Modeler version 18.1.
Digital Communication Information and Communication Technology (ICT) Usage for Education Sustainability (Al-Rahmietal., 2020)	N== 502	SPSS and PLS-SEM
Student Perspectives of Technology use for Learning in Higher Education (Dabbaghetal., 2019)	N=463	(Not stated)
Adoption of Cloud Based E-learning in Developing Countries: A Combination of DOI, TAM and UTAUT (Kayali & Alaaraj, 2020)	N== 422	Smart PLS
E-Learning Technology Effectiveness in Teaching and Learning: Analyzing the Reliability and Validity of Instruments (Hashim et al., 2020)	N== 150	IBM SPSS version 24

In conclusion, the data collection approach used in this research was informed by a review of previous research on technology integration in online learning. By examining how earlier studies selected their sample sizes and carried out their data analysis, this research adopted similar strategies to ensure consistency and reliability. Drawing from these references, the sample size chosen aligns with the common range found in past studies, reflecting established practices in researching the impact of technology on teaching and learning. This approach helps to strengthen the validity of the findings and supports the overall aim of understanding student engagement in an online learning environment using collaborative technology. In addition, the next section will provide a detailed explanation of the sampling approach used in this research, including the type of sampling technique selected, the criteria for participant

selection, and the justification for the chosen sample size to ensure the accuracy and relevance of the study findings

3.5.3 Sampling

Based on previous literature, in conducting research, there are two types of sampling techniques, namely Probability Sampling and Non-probability Sampling, as shown in Figure 3.9 (Makwana et al., 2023). Probability sampling means every item in the population has an equal chance of being included in the sample. There are several techniques under Probability Sampling, which are Simple random sampling, Stratified sampling, Cluster sampling, Systematic sampling, and multi-stage sampling (Pace, 2021). This research chooses to use cluster sampling to determine the sample of respondents. Cluster sampling is a sampling technique where a large population is divided into smaller groups called clusters. Then, a few of these clusters are randomly chosen, and all members within those selected clusters are included in the study (Pace, 2021). The respondents of this research would be the students who have experience in using collaborative technology to perform online learning.

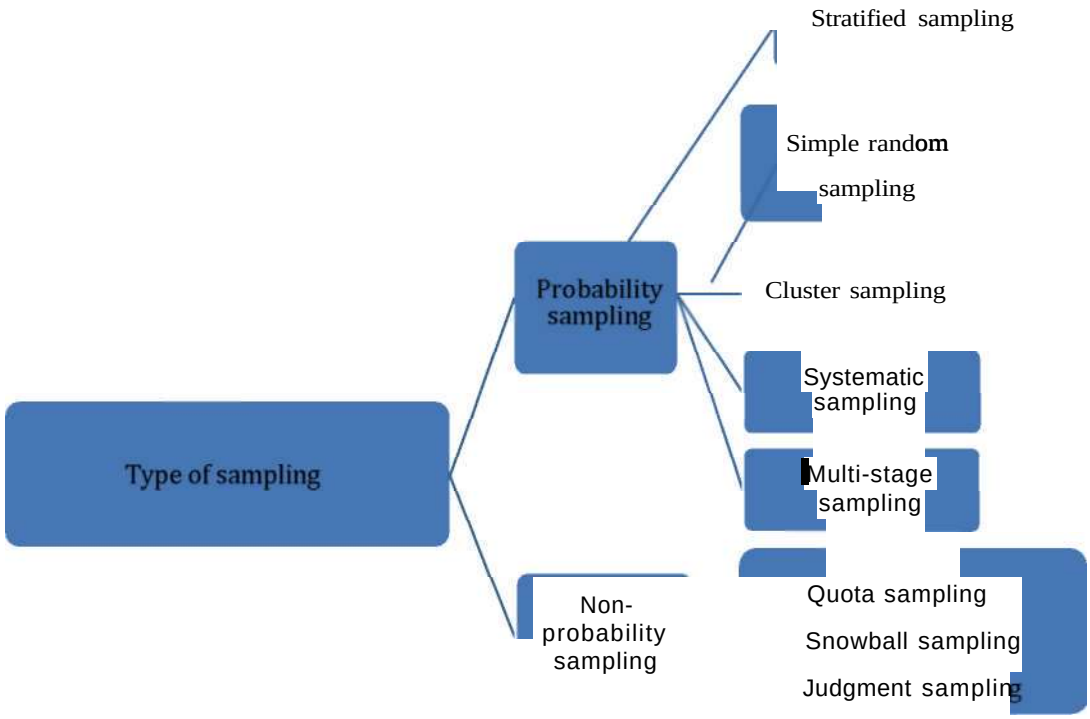


Figure 3.9 Types of Sampling

The sample population for this research was the students from secondary schools in Kelantan from each cardinal point. Since it is unable to have a specific number of students in each selected school, this research utilized a cluster sampling. Cluster sampling is a sampling method used to select a sample from a large population by dividing the population into smaller groups, known as clusters (Rahman et al., 2022). Rahman explained that these clusters are usually natural or existing groups, such as schools, neighborhoods, or classes. Instead of selecting individuals directly from the entire population, a number of clusters are randomly chosen. Then, all members within the selected clusters are included in the sample. This method is practical when it is difficult or costly to list every individual in the population (Ahmed, 2024). S. K. Ahmed also mentioned that cluster sampling helps reduce time and expenses while still allowing researchers to obtain a representative sample, especially when the clusters are similar to each other.

In this research, cluster sampling is chosen because the population consists of students spread across different groups, such as classes or schools, making it challenging to compile a complete list of all students. By selecting entire clusters, the researcher can efficiently gather data from a manageable number of groups while maintaining the representativeness of the sample. This approach is especially useful when the focus is on students who have experience with collaborative technology for online learning, as clusters can be naturally formed around classes or study programs where such technology is used (Pace, 2021). As mentioned earlier, the number of respondents is around 300 to 500 students who are aged between thirteen to fifteen years old, which will be approximately 120 students from each point West, East, North, and South in Kelantan that involves several areas of Gua Musang, Kota Bharu, Machang, Jeli, Tanah Merah, Bachok, and Pasir Puteh. The respondents are form 1 to form 3 students who were chosen to answer the questionnaire. Further, this research follows the procedure by Woosnam (2012) to reduce nonresponse bias besides, the data collection took place on different days within three months. In addition, according to Iliyasu & Etikan (2021), it is cost-effective and saves time, especially when the population is large and spread out. It is useful when it is difficult to get a complete list of the entire population, but easier to list groups. Therefore, cluster sampling was found to be the most appropriate method for reaching the targeted student population in this research.

Schools were selected using a cluster sampling method to ensure geographic representation across Kelantan. First, the study area was divided into cardinal zones (north, south, east, west, and central) that cover the main districts of Kelantan, including Gua Musang, Kota Bharu, Machang, Jeli, Tanah Merah, Bachok, and Pasir Puteh. These zones served as a group to reflect local differences in culture, infrastructure, and internet access. A complete list of mainstream secondary schools in each district was obtained from the state education office and used as the sampling frame. From each stratum, schools were randomly chosen to avoid selection bias. The number of schools chosen per zone was roughly distributed according to the number of mainstream secondary schools in that zone to preserve representativeness. After schools were selected, school administrators were contacted for permission, and ethical approval and consent procedures were followed before data collection.

This research followed ethical procedures to protect secondary school students. The participation was volunteer by the students, monitored by their teachers and administered by the author. All data were kept confidential, and participants' identities were anonymized. The research ensured that questions and procedures were age-appropriate and posed no risk of harm. Approval for the research was obtained from the UiTM Research Ethics Committee (REC), which confirmed that the study complied with institutional and national ethical standards for research involving human participants.

3.5.4 Research Instrument

To effectively gather data aligned with the research objectives, a structured research instrument was required. The author developed a questionnaire based on the proposed research model for the data collection. The answer options would be based on the 5-Likert scale, which are 5=Strongly agree, 4=Agree, 3=Neutral, 2=Disagree, l=Strongly Disagree. The questionnaires were answered by students based on their experience in using collaborative technology to perform online learning to investigate their engagement according to some factors that were determined. This research adapted existing questionnaires according to student engagement dimensions and Social Presence Theory (SPT) elements. For the research procedures, the questionnaires are distributed physically at the schools in Kelantan and answered by students on the spot while administered by the author and monitored by the school teachers. According to

sample sizes from previous researchers that investigated the integration of technology in education, as summarized in Table 3.3, the number of respondents is in the range of 300 to 500 students. All the answers from the feedback are directly saved in Excel format for the data analysis.

The questionnaire includes demographic information such as gender, age, and do they have experience in online learning for Section A. Next, the respondents must answer the questions regarding student engagement based on their online learning experience in Section B. There are three sets of questions which are Collaborative Technology, Social Presence, and Student Engagement. All the questions must be answered by the respondents in a total of 77 questions. The summary of the questionnaire is shown in Table 3.2. In conducting surveys, several techniques or methods can be used, and this research uses self-administered questionnaires as a tool for the purpose of data collection, since it is widely used by past researchers (Zimba, 2023). Briefly explained, a self-administered survey is when the respondents complete the questionnaire by themselves, but with the guidance of the author, and are monitored by teachers.

Table 3.2
The Summary and Source of the Questionnaire

Part	Construct	Number of items	Sources
A	Demographic	3	(Okwuduba et al., 2022)
B	Collaborative technology	20	(Alanazi, 2019b)
B	Social Presence	30	(Alanazi, 2019b)
B	Student Engagement	27	(Mwita et al., 2015) (Nelson, 2020)

The objectives of the research instrument are focused on supporting both the design and validation of the proposed research model. Specifically, the instrument developed in the form of a structured questionnaire is intended to measure the key constructs and variables that form the foundation of the model. The data collected through this instrument enables the researcher to examine the relationships among these variables and assess the overall fit and reliability of the model. In this research, the findings derived from the questionnaire are used to validate the proposed research model, known as the Student Engagement Model. This model brings together theoretical and empirical insights from multiple frameworks, including collaborative

technology, social presence theory, and the multidimensional framework of student engagement. Each of these frameworks contributes specific constructs to the model, for instance, how technology supports collaboration, how social presence influences online interactions, and how students engage cognitively, emotionally, and behaviorally in an online learning environment.

Before proceeding with the main data collection, a pilot study was conducted to evaluate the effectiveness, clarity, and reliability of the research instrument. This preliminary phase involved administering the questionnaire to a smaller, representative sample of the target population in order to identify any issues related to question wording, structure, or interpretation. The pilot study served as an essential step to ensure that the instrument accurately measured the intended constructs and was appropriate for the context of the research. The procedure of the pilot study is explained in the next section.

Table 3.3
The Summary and Source of the Questionnaire

Constructs		Item no.	Item statement
Collaborative technology	Community Cohesion	CC1	I can develop a sense of collaboration with my friend
		CC2	I greet my friend in online class
		CC3	My friend greets me in online class
		CC4	I can feel the presence of my friends in online class
		CC5	I feel that the relationship between me and my friend in online class is the same as in real classroom
		CC6	I called my friend by their nickname
		CC7	My friend called me with my nickname
		CC8	I used 'we' to discuss with my friend in online group discussions
		CC9	I feel I am part of a learning group
		CC10	The online group discussion was effective and makes me feel united
	Knowledge and Experience	KE1	My teacher shared his/her relevant experience with online class
		KE2	My teacher seemed to have a lot of knowledge in the field they teach
		KE3	The teacher seemed to have experiences with technology
		KE4	The teacher seemed to have the expertise to do his/her job
		KE5	The teacher had online teaching

		experience
	KE6	My teacher helps me in using online discussion applications
	KE7	My teacher used suitable application for teaching
	KE8	I'm very satisfied with the learning process of online class
	KE9	I'm very satisfied with the learning outcomes of online class
	KE10	I will recommend to my friends to participate in online class
	AA1	I have different impressions towards my friends in class
	AA2	I projected who I am to other course participants
Affective Association	AA3	I expressed emotions in the online class
	AA4	I share personal information about life outside of online class
	AA5	My friends share personal information in the online class
	AA6	My friends make me feel very friendly while participating in online class
	AA7	I can get emotional support from my friends while participating in online courses
	AA8	I work together with my friends while participating in online class
	AA9	Online class can better motivate my interest in learning than traditional classroom
	111	I expressed agreement or disagreement with my friends or the content of my friend's ideas
	112	I complimented others or the content of my friend's ideas
Interaction Intensity	ID	I felt comfortable participating in online discussions
	114	I felt comfortable interacting with my friends
	115	I received answers to the questions I asked
	116	I can easily obtain the detailed information that I want while participating in online class
	117	My friends communicated effectively using online communication tools (e.g. email, and instant messaging)
	118	I always discuss learning problems with

		my friends while participating in online class
	119	I always share learning materials and ideas with my friends while participating in online class
	mo	I always discuss learning objectives with my friends while participating in online class
	IIV1	The teacher gives fast respond to students' questions
	IIV2	The teacher was always available
	IIV3	The teacher participated in the online discussions frequently
Instructor Involvement	IIV4	The teacher support student engagement in the online discussions
	IIV5	The teacher provided high quality feedback
	IIV6	The teacher always provided useful feedback
	IIV7	The teacher helps to improve student engagement in the online discussions
	IIV8	The teacher always starts the online discussions
	IIV9	The communication between teacher and students is good
	IIV10	I find the teacher helpful when asked questions
	Bl	When I'm in class, I participate in class activities
	B2	When I'm in class, I'm not focus
	B3	I try hard to do well in the class
Behavioral	B4	I pay attention in the class
	B5	If I have trouble understanding, I go over it again until I understand it
	B6	When I run into a difficult homework problem, I keep working at it until I think I've solved it
	B7	I feel I can take the responsibility of my own learning
	B8	I have learned more about using computers for presenting information
	B9	I am an active participant in the school activities
	BIO	I feel confident in using computer applications when needed
	CI	When I study, I figure out how the information might be useful in the real world

	C2	When I learning, I try to put the ideas in my own words
Cognitive	C3	When studying, I try to combine different information from learning material in new ways
	C4	I create and find my own examples to help me understand the important concepts I learn in classes
	C5	I try to see the similarities and between things I am learning in classes and things I know already
	C6	I try to think through the topics and decide what I'm supposed to learn from them, rather than studying topics by just reading them over
	C7	I have been challenged to come up with new ideas
	C8	I have become more confident of my ability to continue study
Emotional	E1	I think what we are learning in school is interesting
	E2	I think learning is boring
	E3	I am very interested in learning
	E4	I think learning in school is interesting
	E5	I like what I am learning in school
	E6	I enjoy my class
	E7	I am proud to be in the class
	E8	Every morning, I cannot wait to going to the class
	E9	I feel accepted in my class group discussions

3.5.5 Pilot Study

A pilot study was conducted prior to the implementation of the actual research to ensure the quality and effectiveness of the research instrument. The primary purpose of the pilot study was to serve as a preliminary investigation aimed at identifying potential issues related to the clarity, structure, and relevance of the questionnaire items. This step is essential in the research process, as it allows researchers to detect and correct any problems in the instrument, such as ambiguous wording, unclear instructions, or technical difficulties, before distributing it to the full sample in the main

study. By doing so, the reliability and validity of the data collected can be significantly improved.

For the pilot study, the questionnaire was distributed to a sample of 50 students selected randomly from various secondary schools across Kelantan. The distribution was carried out through the WhatsApp application, allowing easy and direct access to respondents. The selected students were from Forms 1 to 3 and were chosen to represent the characteristics of the target population. Importantly, the students who participated in the pilot study were not included in the actual study. This was done to prevent bias and ensure the independence of the main study results. The feedback and responses gathered during the pilot phase were carefully reviewed and used to refine the final version of the questionnaire before it was officially administered in the full-scale research. To interpret and make sense of the data collected through the questionnaire, appropriate data analysis techniques were employed to examine the relationships between variables and to test the proposed research model.

A total of 50 students were selected to participate in the pilot study to ensure that the survey instrument could be tested for clarity, reliability, and suitability before being used in the main data collection. According to Bujang et al., (2024), the sample for pilot study does not need to be large, but it must be sufficient to identify problems in wording, item interpretation, response patterns, and survey administration procedures. Many methodological guidelines recommend a pilot sample between 10-30 participants. Therefore, using 50 students therefore exceeds the minimum requirement and allows for more stable feedback and preliminary reliability testing.

3.5.6 Data Analysis Software

After collecting the completed questionnaires from all respondents, the data obtained were carefully compiled and entered into an electronic database for organization and management. Initially, the raw data were exported from Microsoft Excel, where preliminary cleaning and coding processes were performed to ensure accuracy and consistency. Following this, the prepared dataset was imported into SPSS software, which was used to conduct a comprehensive analysis. This software facilitated various statistical procedures to explore the data and evaluate the relationships among the variables in the study, providing a thorough understanding of the research findings. The procedure of analysis is explained in the next section.

3.6 Data Analysis

This section outlines the procedures and techniques used to analyse the data collected in this research. The goal of the data analysis is to identify patterns and draw meaningful conclusions based on the research objectives. Depending on the nature of the data either quantitative, qualitative, or mixed, appropriate analytical methods were selected to ensure accuracy, reliability, and validity. Statistical tools or software platforms such as SPSS, Excel, NVivo, or Python were employed to process and interpret the data systematically. The following subsections detail the specific steps taken to prepare, analyze, and present the results.

3.6.1 Descriptive Analysis

Descriptive analysis is used to summarize data by describing the relationship between characteristics or traits or also known as variables, in a sample or population (Pyzdek, 2021). As for this research, it describes the demographic characteristics, which are age, gender, and experience in online learning. Descriptive statistics is a critical part of initial data analysis since it provides the foundation for comparing variables.

3.6.2 Reliability Analysis

Reliability is one of the indicators of stability, measured values obtained from repeated measurements that were used for measuring instruments. In order for the result to be reliable in measuring instruments, it is essential to ensure the results are sturdy. Several methods can be used to determine reliability, and one of them is Cronbach's alpha to test internal consistency. Cronbach's alpha is used in the context of multi-item measurement instruments (Amirrudin et al., 2020; Brandstrup et al., 2024). Plus, it is a widely-used measure of reliability used to quantify the amount of random measurement (Hayes & Coutts, 2020; Brandstrup et al., 2024). Briefly, the use of Cronbach's alpha refers to how closely related a group of items is to one another. It is mainly used when multiple Likert scales are being used in the research to determine whether the scale is reliable. Table 3.3 shows the standard level of reliability with the values (Izah et al., 2024).

Table 3.3
The Value of Cronbach's Alpha Reliability

Cronbach's Alpha	Reliability Level
$a>0.9$	Excellent
$0.9>a>0.8$	Good
$0.8>a>0.7$	Acceptable
$0.7>a>0.6$	Moderate
$0.6>a>0.5$	Poor
$a<0.5$	Unacceptable

3.6.3 Normality Test

Conducting a normality test is necessary to decide whether a parametric or non-parametric test needs to be used. A parametric test is usually used in cases where the data have a normal distribution. If the data do not have a normal distribution, non-parametric data will be used to analyze it (Demir, 2022). Parametric is based on a specific distribution, such as the normal distribution, and can be used in conditions where the normality assumption is provided. However, non-parametric methods do not assume such distributions and are implemented independently of the distribution (Abdi, 2023). There are different ways suggested in the literature to test normality. Normality of data can be checked based on skewness and kurtosis values. Skewness is related to the status of the data's mode, median, and mean relative to each other. Meanwhile, kurtosis is related to how far the data move away from the mean or how close it is to the mean (Demir, 2022). The value of skewness and kurtosis is suggested to be an absolute value of 1, which may indicate normality, while some suggest it to be much larger values for normality. For this research, the values for skewness are in the range of -2 to +2, and the value of kurtosis is between -7 to +7, which are considered acceptable to prove normal distribution (George & Mallery, 2010; Baumgartner et al., 2022; Malinauskas & Saulius, 2021; Demir, 2022). Therefore, if the value of the result for this research is within the acceptable range, it means that the collected data were normally distributed.

3.6.4 Pearson Correlation Test

Pearson's correlation coefficient is a statistical test that is used to measure the statistical relationship or association between two continuous variables (Ndako et al., 2020; Temizhan et al., 2021). It is used to investigate the relationship between the

variables. According to Sreedevi (2022), the correlation coefficients are used to assess the strength and direction of the linear relationship between pairs of continuous variables, and when the variables are normally distributed, a Pearson correlation is used. Table 3.4 shows the interpretation of correlation based on the value.

Table 3.4
Rule of Thumb for interpreting the size of correlation according to Guilford's Law

Size of Correlation (r)	Interpretation
0.80 > r > 1.00	Very high positive correlation
0.60 >r>0.80	High positive correlation
0.40 > r > 0.60	Moderate positive correlation
0.20 > r > 0.40	Low positive correlation
0 > r > 0.20	Negligible correlation
0 > r > -0.20	Negligible correlation
-0.20 > r > -0.40	Low negative correlation
-0.40 > r > -0.60	Moderate negative correlation
-0.60 >r>-0.80	High negative correlation
-0.80 > r > -1.00	Very high negative correlation

Correlation is a measure of the association between variables. Typical values for correlation are in the range of -1 to +1 or 0 to +1, where 0 means no statistical association, +1 means the strongest possible association, and -1 means the strongest negative relation (Baak et al., 2019; Burgund & Nikolovski, 2023). Also, a positive correlation coefficient implies an increase in one indicator would result in an increase in another indicator, and vice versa (Djordjevic et al., 2021; Burgund & Nikolovski, 2023). The relationship gets stronger and ultimately approaches a straight line as the coefficient approaches an absolute value of 1.

3.6.5 Multiple Linear Regression

Multiple Linear Regression is used to find out how a dependent variable can be predicted using an independent variable (Alita et al., 2021). Also, multiple linear regression methods will explain the relationship pattern between the variables used in the model. Based on a study by Mardiatmoko (2024), before analyzing with multiple linear regression, each variable must be tested using classic regression assumptions that include the normality test, linearity test, heteroscedasticity or homoscedasticity test, multicollinearity test, and autocorrelation test. Another researcher in a previous study also states that there are four classical assumption tests, which are the normality test,

heteroscedasticity test, autocorrelation test, and multicollinearity test (Rafika Rakhmah & Jha, 2024). This research included normality tests or also called normality assumptions, heteroscedasticity or homoscedasticity, and multicollinearity tests.

3.6.5.1 Model Adequacy Checking

The primary diagnostic tool for model adequacy checking is the residual analysis, which is mostly done by graphical analysis in different forms and simply called residual plots (Kamel & Abonazel, 2023). Basically, model adequacy checking was done to check the assumption of a regression model. Normality plot and residual versus predicted plot were used to check both normality of the error and homoscedasticity of the error assumptions (Nordin et al., 2022).

i.Normality Assumptions

There are many methods to assess normality assumption, and one of those methods is the skewness and kurtosis test (Wulandari & Bayu, 2021; Hatem et al., 2022). Typically, when it comes to normality assumptions, it will state that the sample was drawn from a population that was normally distributed (Tsagris & Pandis, 2021). According to Burnecki etal., (2021), there are two common ways to check the normality assumption, which are graphical and numerical methods. The most popularly used graphical test of normality is the quantile-quantile plot (QQ-plot) and histogram, probability-probability plot (PP-plot), box-plot, and stem-and-leaf plot are other graphical methods of normality (Bisarya, 2023). Guzik & Wie/ckowska (2023) suggest assessing normality with a probability-probability plot (PP-plot) as it is applied to the standardized effect estimates. When assessing normality, two graphical tools that are often utilized are probability-probability plot (PP-plot), normal quantile-quantile (QQ) plots, and histograms (Casement & Mcsweeney, 2022). This research chooses to use a probability-probability plot (PP-plot) for the result of the Normality assumption.

ii. Heteroscedasticity and Homoscedasticity

Heteroscedasticity is a phenomenon where a data set violates a statistical assumption, while Homoscedasticity means the variance of the error term is constant,

and when the assumption is violated in the case of heteroscedasticity, the variance depends on the sampling index or the value of influencing variables (Günther & Runge, 2022). Besides, heteroscedasticity is a significant problem in regression analysis and occurs in any situation where the error variance is not constant (Osaro, 2023). Meanwhile, according to Mcroberts & Blujdea (2022) the purpose of the heteroscedasticity is to see whether the variable variance in the model is the same or not. One of the methods to examine the existence of heteroskedasticity is visually viewing the residuals of the estimated model (Djalic & Terzic, 2021; Mcroberts & Blujdea, 2022). It is usually in the form of a point scattering diagram of residual or their absolute value of the independent variable. Based on that, it can be concluded whether heteroscedasticity exists.

iii. Multicollinearity

Multicollinearity is a common problem as the dependencies between variables can vary over time and change (Chan et al., 2022). In short, multicollinearity indicates linear relationships among independent variables. Multicollinearity occurs when the regression model includes multiple variables that are significantly correlated not only with the dependent variable but also with each other (Shrestha, 2020; Chan et al., 2022).

3.6.5.2 Goodness of Fit of the Model

Goodness-of-fit refers to the quality that can be thought of in terms of how well a model fits a set of observations. The coefficient of determination is perhaps solely the most extensively applied measure of goodness-of-fit, especially for regression models (Onyutha, 2020; Onyutha, 2022). Chicco et al., (2021) stated that the coefficient of determination can be interpreted as the proportion of the variance in the dependent variable that is predictable from independent variables. R^2 is used to evaluate the extent to which the regression model can predict the data. The closer the value of R2 is to 1, the more significant the linearity and the more accurate and reliable the estimation results (Xu et al., 2022). Moreover, the value of R-square (R2) that is used as a goodness-of-fit model test shows how much the independent variable explains the dependent variable. The value of R2 is between 0 to 1. If the value of R2 is closer to 1,

it can be said that the independent variable provides all the information needed to predict the variation of the dependent variable (Fauzi & Ali, 2021).

3.6.5.3 Significance of the Model

Model validation is an important step in the modeling process and helps in assessing the reliability of models before they can be used in decision-making (Yildirim & Sisman, 2023). Based on several past research studies, most of them were used analysis of variance (ANOVA) in order to assess the significance of the model (Timofeeva et al., 2020; Graphitic et al., 2021; Ravindiran et al., 2022; Rozing et al., 2023). As a mathematical model for analyzing the collected data, ANOVA seems to be the most appropriate model to use. ANOVA is a statistical analysis used to analyze the difference between the means of more than two groups. "Its purpose is to predict a single dependent variable based on one or more predictor variables and to establish whether those predictors are good predictors" (Reji & Kumar, 2023).

3.6.5.4 Significant Variable Checking

The statistical significance is performed using the significant value which is p-value, with a significance level of 0.05. If the probability value (p) is less than 0.05, it means the hypothesis is rejected (Niati et al., 2021). Usually, ANOVA is used where if p-values are less than 0.05, it is considered statistically significant and the null hypothesis is rejected. Conversely, if the p-value is more than 0.05, it is considered statistically non-significant (Bergh et al., 2020; Rovetta & Mansournia, 2024).

3.6.6 Statistics Technique

The summary of the methods of analysis used for each research objective for this research are as shown in Table 3.5.

Table 3.5
Methods of Analysis for Research Objectives

Objectives	Method of Analysis
1. To explore the existing models for collaborative technology usage of online learning in Malaysian context.	Literature Review Analysis
2. To design a student engagement model for collaborative technology with social presence theory in online learning.	Reliability Analysis Pearson's Correlation Test
3. To validate the student engagement model for collaborative technology usage in online learning using Multiple Linear Regression.	Multiple Linear Regression

3.7 Chapter Summary

Overall, this chapter provides a comprehensive overview of the research methodology employed to carry out this research. It begins by explaining how the proposed research model was developed, including the theoretical foundations and the key constructs integrated into the model. The chapter then outlines the data collection methods used to gather information from the selected respondents, detailing the sampling techniques, the design of the research instrument, and the steps taken to ensure data quality, such as the pilot study. Furthermore, the chapter describes the procedures followed throughout the research process, including how the questionnaire was distributed and the measures taken to address potential challenges like nonresponse bias. It also elaborates on the data analysis methods applied, including both descriptive and statistical techniques, as well as the software tools used for processing the data. Essentially, this chapter serves to clarify the entire research process, providing a clear framework for how the data was collected and analyzed. It sets the foundation for the next chapter, where the results obtained from these methods will be presented,

interpreted, and discussed in detail. By understanding the methodology, readers can better appreciate the validity and reliability of the findings that follow.

CHAPTER 4
ANALYSIS OF STUDENT ENGAGEMENT MODEL

4.1 Introduction

This chapter presents the results and analysis of the data collected through the distribution of questionnaires to the selected sample. The primary focus is to examine the validity of the proposed Student Engagement Model by analyzing the responses gathered from students who have experience with collaborative technology in online learning. The data were collected using a structured questionnaire, as outlined in the previous chapter, and analyzed using appropriate statistical methods to ensure accuracy and relevance. The findings in this chapter are directly aligned with the research objectives and aim to provide empirical evidence on the relationships between the key constructs of the model, which are based on collaborative technology, social presence theory, and the multidimensional framework of student engagement. This chapter begins with descriptive statistics to summarize the demographic characteristics of the respondents, followed by the analysis. Ultimately, this chapter aims to determine whether the proposed model is supported by the data and how strongly it relates to student engagement in online learning.

4.2 Pilot Study

In conducting research, a pilot study is a crucial part to explore the selected population and the reliability of the test. Therefore, this research conducted a pilot study to test with 50 students from randomly chosen secondary school students in Kelantan. To analyze the reliability of this pilot test, Cronbach's alpha was used to determine the value of each variable. According to Luh (2024) Cronbach's alpha is a widely used measure of reliability used to quantify the amount of random measurement. If the result is within the acceptable value range, it means the test is reliable. Generally, the value of Cronbach's alpha needs to be more than 0.7 as it is considered ideal for an assessment (Izah et al., 2024).

4.2.1 Reliability Analysis for Pilot Study

The Cronbach's alpha reliability coefficient was analyzed, and the results are shown in Table 3.3 in Chapter 3, which shows the Cronbach's alpha value of each variable. The alpha value ranges from 0 to 1, but if the value obtained is higher than 0.70, the result is considered acceptable. According to Barbera et al., (2021), an acceptable criterion of Cronbach's alpha value is 0.70, which means it is a reliable value. The same goes for, as stated in the study by Rushton et al., (2023), the reliable value of Cronbach's alpha is more than ($a > 0.70$). If the value obtained is more than or equal to 0.70, it means the result is reliable. As can be seen in Table 4.1, the pilot study results of Cronbach's alpha for all variables are reliable, which is more than 0.70.

There are three variables tested for the pilot study. The pilot study results demonstrate high internal consistency across all constructs measured. Specifically, the Cronbach's alpha values for the independent variable, which is collaborative technology ($a = 0.895$) and social presence ($a = 0.918$), as well as for the dependent variable, student engagement ($a = 0.897$), all exceed the commonly accepted threshold of 0.80, indicating strong reliability. Cronbach's alpha is a measure used to assess the internal consistency of a set of survey items, reflecting how closely related the items are as a group (Kennedy, 2022). According to Kennedy, values above 0.80 suggest that the items within each construct are highly interrelated and reliably measure the intended underlying concept.

Table 4.1
Cronbach's Alpha value for Pilot Study Analysis (n=50)

Variables	**Number of questions**	**Cronbach's Alpha**
Collaborative technology	20	0.895
Social Presence	30	0.918
Student Engagement	27	0.897

In these findings, these strong reliability results are significant because they show that the questionnaire is clearly designed and able to accurately measure the views and experiences of the respondents. In addition, the results suggest that the instrument is appropriate for use in the full research study, giving a strong base for collecting reliable and meaningful data. The positive outcome of the pilot study not only supports the quality of the research design but also builds trust in the findings that will be

gathered in the main study. Besides, the result of the pilot study supports stronger conclusions, more meaningful insights, and the potential for the findings to be applied or generalized to similar contexts in the future. Overall, the questionnaire shows good reliability, which means the questions give consistent answers. This shows that the questionnaire is suitable for the main study. The questionnaire provides a good base for collecting reliable and meaningful data.

4.3 Results and Findings for Actual Study

After successfully completing the pilot study and confirming the reliability of the research instrument, the actual research was carried out. The purpose of the actual study is to collect data from a larger and more representative sample in order to test the proposed research model and achieve the research objectives. Unlike the pilot study, which focused on a small group to assess the instrument's quality, the main study involves full-scale data collection to examine the relationships between key variables, which is collaborative technology, social presence, and student engagement. The findings from the actual study provide deeper insights and allow for meaningful analysis and interpretation, contributing to the overall understanding of student engagement in an online learning environment using collaborative technology.

This section specifically discusses the data analysis conducted in the main study, including descriptive analysis to summarize the demographic profile of the respondents, reliability analysis to assess the internal consistency of the constructs, and the normality test to check whether the data meet the assumptions required for further statistical testing. In addition, Pearson correlation analysis is used to determine the strength and direction of relationships between variables, while multiple linear regression analysis is applied to examine the influence of independent variables, namely collaborative technology and social presence, on the dependent variable, student engagement.

This section is important because it transforms raw data into meaningful findings that directly address the research questions and objectives. By applying appropriate statistical methods, this section helps to validate the research model and provides evidence-based conclusions. The results presented here also serve as the foundation for the interpretation and discussion in the next chapter, ensuring that the study's conclusions are supported by accurate and reliable data.

4.3.1 Descriptive Analysis

Descriptive analysis is used to provide a clear summary of the data collected from respondents, helping to present an overall picture of the sample's background. It involves organizing and interpreting data in a meaningful way to understand the characteristics within the dataset. In this research, descriptive analysis focuses on the demographic profile of the respondents, which is essential for understanding the context of the research and interpreting the results accurately. By examining demographic variables, the researcher can identify trends and ensure that the sample reflects the target population. There are three characteristics of the respondent's demographic information for this research, which are age, gender, and their experience in online learning. Based on the data collected, most of the students from different cardinal points of Kelantan had experienced online learning. For age and gender, it is explained in the form of a bar chart, as in Figure 4.1 and Figure 4.2. And for the online learning experience is explained in Figure 4.3.

4.3.1.1 Analysis of Gender

The demographic characteristics of the respondents help to define the sample group in this research. According to Figure 4.1, the majority of the participants were female, with a total of 319 students representing 63% of the sample. This indicates that female students were more actively involved in the study compared to their male. On the other hand, male respondents involved 184 students, representing 37% of the total participants. This gender distribution reflects the characteristics of the participants and may have implications for interpreting the study results, especially if gender-related differences influence experiences with online learning or engagement levels.

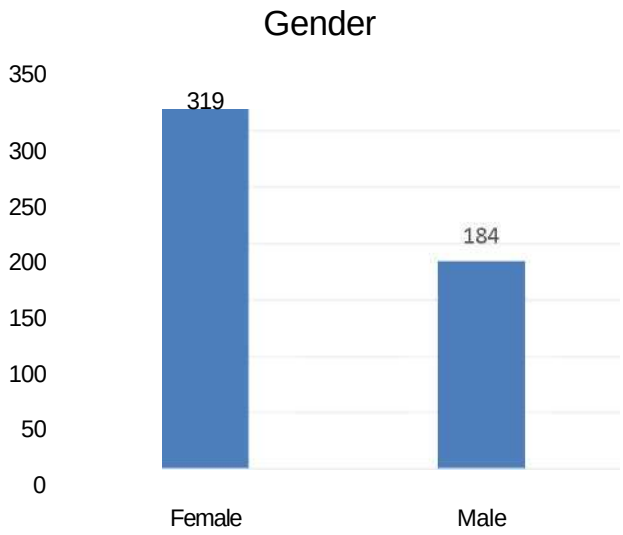


Figure 4.1 Number of Respondents by Gender

4.3.1.2 Analysis of Age

Understanding the age distribution of the respondents is important to provide context about the participants. This research includes students aged between 13 and 15 years old. As shown in Figure 4.2, out of a total of 503 students, 159 students (31%) are 13 years old, 175 students (33%) are 14 years old, and 169 students (36%) are 15 years old. This shows that the participants are fairly evenly spread across the three age groups, which helps ensure that the findings represent the experiences of students within this age range.

Figure 4.2 Number of Respondents by Age

*4.3.1.3 Analysis **of** Online Learning Experience*

It is important to understand the students' experience with online learning to provide context for this study. The results for the third demographic question show that all 503 students (100%) have experienced online learning, as illustrated in Figure 4.3. This finding is expected because most students today are familiar with using collaborative technology for their learning activities. This aligns with the study by Famularsih (2020), which also found that online learning has become a common part of students' education.

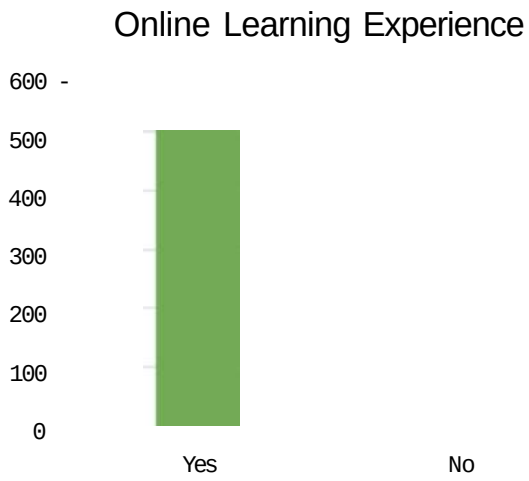


Figure 4.2 Students' Online Learning Experience

4.3.2 Reliability Analysis for Actual Study

The reliability results for each variable in this study are shown in Table 4.2. The variables measured are collaborative technology, social presence, and student engagement. All three showed high reliability, with Cronbach's alpha values above the acceptable level of 0.70. Specifically, the reliability score for collaborative technology was 0.856, for social presence it was 0.925, and for student engagement it was 0.894. These results show that the survey questions used to measure each variable are consistent and reliable. A high Cronbach's alpha value means that the questions in each group are closely related and measure the same idea. Since all values are above 0.80, it can be concluded that the items in each variable are strong and suitable to be used in the research. This means the survey tool used in this study is dependable and can be trusted to give accurate results.

Table 4.2
Cronbach's Alpha value for All Variables in SEM (n=503)

Variables	Number of questions	Cronbach's Alpha
Collaborative technology	**20**	0.856
Social Presence	**30**	0.925
Student Engagement	**27**	0.894

When synthesizing these findings, it is evident that the instrument used in this research is both valid and reliable for assessing the proposed student engagement model. The strong internal consistency across variables indicates that the theoretical constructs, which are collaborative technology, social presence, and student engagement, are well-represented by the survey items. This reinforces the relevance of using these constructs together, as they are not only conceptually connected but also empirically supported. These results align with research by Md Sabri et al., (2024) that highlights the importance of a reliable measurement tool in educational research, particularly in models involving engagement and technology integration. Therefore, the strong reliability values not only confirm the quality of the instrument but also provide a solid foundation for further analysis and validation of the proposed research model.

This study measured three key areas: collaborative technology, social presence, and student engagement. The quality of the survey was tested using Cronbach's alpha, which shows whether the questions under each area are consistent and measure the same idea. All three areas recorded Cronbach's alpha values above 0.80, indicating a high level of consistency among the questions. This means the items within each group worked well together and did not measure unrelated ideas. Since all values are above the accepted minimum level of 0.70, the survey can be considered dependable and suitable for further analysis. The strong reliability results suggest that collaborative technology, social presence, and student engagement are clearly defined and well represented in the survey. Together, these findings provide confidence that the survey is of good quality and offers a solid foundation for examining the relationships within the student engagement model.

4.3.3 Normality Test

As mentioned in chapter 3, the value of skewness and kurtosis is suggested to be the absolute value of 1, which may indicate normality, while some others suggest it

to be much larger values for normality. But for this research, the values for skewness and kurtosis are in the range from -2 to +2 in which is considered acceptable to prove normal distribution. The values of skewness for each variable are shown in Table 3.6 in the previous chapter. As shown in Table 4.3, the skewness values for all three variables fall within the acceptable range for normal distribution, with values of -0.061 for Collaborative Technology, -0.301 for Social Presence, and -0.180 for Student Engagement. The normality test is used to check if the sample data comes from a population that follows a normal distribution, which is an important assumption for many statistical tests. According to George and Mallery (2010), and supported by recent research, skewness values between -2 and +2 and kurtosis values between -7 and +7 show that the data are normally distributed (Baumgartner et al., 2022; Malinauskas & Saulius, 2022; Demir, 2023). In this research, all the variables have values within these ranges. Therefore, it can be concluded that the data follow a normal distribution and are appropriate for further analysis.

Table 4.3
The Result of the Normality Test

Variables	**Skewness**	**Kurtosis**
Collaborative technology	-0.061	0.580
Social Presence	-0.301	1.010
Student Engagement	-0.180	0.533

When considered in the context of educational technology, these results carry important implications. The normal distribution of data related to collaborative technology, social presence, and student engagement suggests that students responded consistently to items measuring these constructs, reflecting stable perceptions and experiences with technology-mediated learning environments. This supports recent research indicating that well-integrated technological tools can foster uniform user experiences and improve student engagement (Ibrahim & Alshamrani, 2022; Lin et al., 2023). Furthermore, the alignment of these findings with current literature highlights the interconnected nature of collaborative technologies and social presence in shaping student outcomes. The statistical normality of the dataset strengthens the reliability of these associations and supports the integration of technology-enhanced learning strategies in online learning settings. Thus, the results not only validate the measurement instrument but also offer empirical support for the effectiveness of collaborative technologies in promoting positive learning experiences. Plus, the dataset

not only confirms the quality of the measurement instrument but also strengthens evidence for the use of collaborative technologies in fostering social presence and enhancing student engagement.

The data were checked for normal distribution using skewness and kurtosis values, and all results fell within the acceptable range. This shows that the data are balanced and not affected by extreme responses. Students answered the survey in a consistent way, showing stable views on collaborative technology, social presence, and student engagement. This supports the quality of the survey and allows the data to be used confidently for further analysis.

4.3.4 Pearson Correlation Test

All collected samples were analyzed statistically by the Pearson correlation test to identify the correlation between variables. The values for correlation are in the range of -1 to +1 or 0 to +1, where 0 means no statistical association, +1 means the strongest possible association, and -1 means the strongest negative relation (Baak et al., 2019; Burgund & Nikolovski, 2023). This test is to check if the result is significant when the value is in the scale from -1 to +1 indicates the strength of the relationship between the considered variables, whereas the sign of the correlation coefficient indicates the direction of the relationship between variables (N. Al-Rousan, 2020; Temizhan et al., 2021). Table 4.4 summarizes the results of the correlations of two independent variables.

Table 4.4
Result of Pearson's Correlation Test

Variables	Student Engagement		
	Pearson Correlation (r)	**p-value**	**Level**
Collaborative technology	0.686	< 0.001	High
Social Presence	0.749	< 0.001	High

As shown in Table 4.4, the Pearson correlation results reveal a strong positive relationship between the independent variables, which are collaborative technology and social presence, and the dependent variable, student engagement. Specifically, the correlation coefficient for collaborative technology is 0.686, while social presence results in a slightly higher correlation of 0.749. These values fall within the range of 0

to +1, indicating a meaningful and high positive association. According to Wahyuni et al. (2023), a p-value less than 0.05 indicates statistical significance. As all p-values in this study are below 0.05, it can be concluded that the observed relationships are statistically significant.

These findings have important implications within the context of educational technology. The strong positive correlations suggest that as the use of collaborative technologies increases, students tend to report higher levels of engagement. Similarly, enhanced perceptions of social presence, such as feeling connected and supported in a virtual learning environment, are associated with increased engagement. This is consistent with recent research emphasizing the importance of interaction-rich, technology-mediated environments in supporting student motivation and participation (e.g., Lin et al., 2023; Zhang & Khalid, 2022).

When synthesizing these findings, it becomes clear that collaborative technology and social presence do not operate in isolation but are interrelated factors that work together to influence engagement. The integration of collaborative tools such as discussion forums, video conferencing, and shared digital workspaces helps foster a sense of community and presence, which in turn enhances engagement. The positive relationships between these variables suggest that improving one factor is likely to help improve the others. This means the results not only support the ideas behind the research model, but also give real evidence that using technology in learning can help create more active, connected, and engaged students. Overall, it showed strong positive relationships between collaborative technology, social presence, and student engagement. Higher use of collaborative tools and a stronger sense of connection were linked to higher engagement. All relationships were statistically significant, meaning the results are reliable. The findings also show that collaborative technology and social presence work together: using digital tools helps students feel connected, which in turn increases their engagement in online learning.

4.3.5 Multiple Linear Regression

Multiple linear regression is a common statistical method used in research to examine and predict the relationship between one dependent variable and two or more independent variables. The dependent variable is the main outcome that the researcher wants to understand or predict, while the independent variables are the factors believed

to influence or explain changes in that outcome. (cross-reference chapter 3) This analysis technique helps researchers estimate how much each independent variable affects the dependent variable while considering the impact of all other independent variables in the model at the same time. Multiple linear regression examines the relationships between variables, indicating whether an independent variable has a positive or negative effect on the dependent variable, and the strength of its influence.

Multiple linear regression analysis involves several important steps to ensure the model is appropriate and reliable. These steps include checking the model adequacy, which verifies that the model fits the data well and meets necessary assumptions. Next, the goodness of fit of the model is assessed to determine how well the independent variables explain the variation in the dependent variable. The significance of the overall model is tested to see if the regression equation meaningfully predicts the dependent variable. Finally, the significance of each independent variable is examined to identify which variables have a statistically significant effect on the dependent variable.

4.3.5.1 Model Adequacy Checking

Model adequacy checking is important to make sure the assumptions of the model are met and that the model fits the data well. This includes checking for normality, equal spread of data which is homoscedasticity, and no strong relationship between independent variables which is multicollinearity. In this research, the normality assumption was tested using the normal probability plot of residuals. When residuals follow a normal distribution, the points in the plot will appear close to a straight line with only small scatter, which indicates a well-fitting model (Jasem et al., 2021; Osemeke et al., 2024). The results of this research show that the residuals were normally distributed, as most of the points in the P-P plot in Figure 4.4 follow a straight line. This means there is no major violation of the normality assumption. By meeting this assumption, the model can be considered statistically valid and reliable.

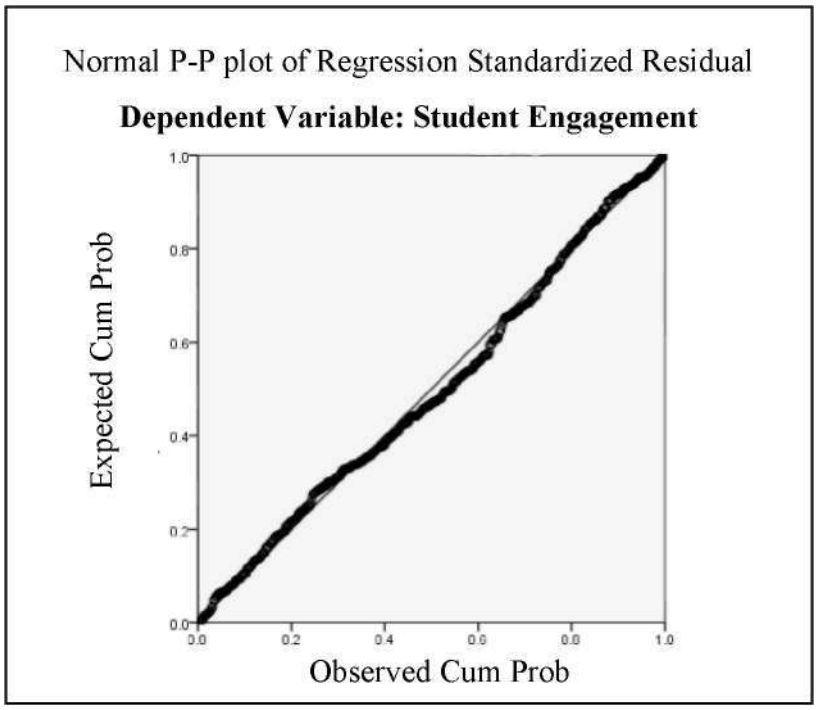


Figure 4.4 Normality Assumption Results

The PP-plot is used to check whether the residuals show that the differences between the observed and predicted values are normally distributed. If the points in the PP-plot fall close to a straight line, it means the residuals are approximately normal, and the model likely meets the normality assumption. This is important because if the residuals are not normally distributed, the results of the analysis can become unreliable or misleading. For example, the standard errors might be incorrect, which could lead to wrong conclusions about the relationships between variables.

In this research, the PP-plot shows that most of the points are scattered closely along a straight line. This suggests that the residuals are normally distributed and the assumption of normality is satisfied. If the residuals are normally distributed, it indicates that the model fits the data well. The P-P plot showed that most points lie close to a straight diagonal line, meaning the residuals are normal and the model meets the normality assumption. This is important because normally distributed residuals ensure that standard errors are accurate, significance tests are reliable, and conclusions about the relationships between variables are valid. Since the residuals in this study follow the expected pattern, the model can be considered statistically sound and trustworthy. Overall, this confirms that the results of the study are reliable, the analysis is valid, and the conclusions drawn about collaborative technology, social presence, and student engagement can be trusted.

After assessing the normality assumption, there is a need to measure the assumptions of homoscedasticity. Homoscedasticity refers to a situation where the variance of the error term namely residuals is constant across all levels of the independent variables. Conversely, heteroscedasticity occurs when the variance of the error term is not constant, meaning it changes or varies with the independent variables. Figure 4.5 shows the scatterplot of residuals that shows no pattern of increasing or decreasing in any circumstances. The purpose of the scatterplot is to satisfy the assumption of homoscedasticity. Thus, it shows that the homoscedasticity of error variance assumption is satisfied.

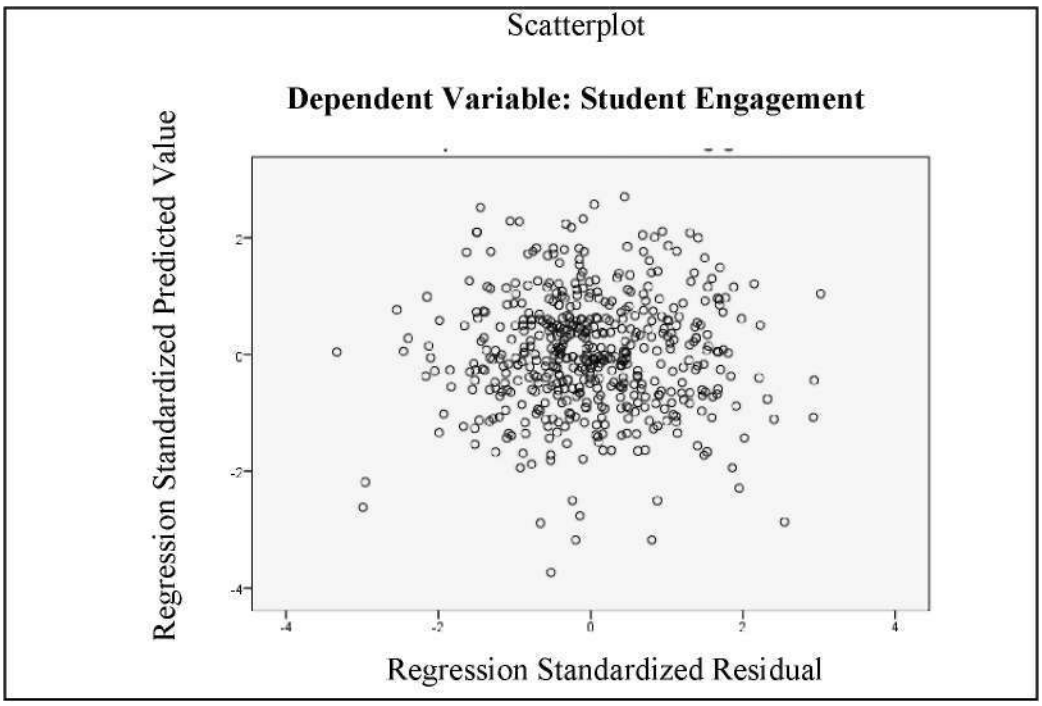


Figure 4.5 Homogeneity Assumption Result

The scatterplot in this research shows that the data points are spread out evenly around the regression line. This means the variance of the residuals is constant across all levels of the independent variables, which is a condition known as homoscedasticity. This is a good sign in regression analysis because it means the model's predictions are consistent and the results are more accurate and reliable. When homoscedasticity is present, the statistical tests used in regression, such as t-tests and F-tests, are more valid. However, if this condition is not met in which a situation called heteroscedasticity, it can lead to biased results, incorrect standard errors, and wrong conclusions.

In the context of this research, the presence of homoscedasticity supports the quality of the model used to examine the relationship between collaborative technology,

social presence, and student engagement. Since the scatterplot confirms constant variance, it adds to the evidence that the regression results can be trusted. This finding strengthens the overall conclusion that the use of technology tools in education, when combined with a sense of social presence, can meaningfully contribute to increasing student engagement. It also shows that the statistical assumptions behind the model are met, making the analysis more robust and the findings more meaningful for technology-supported learning environments. Overall, the scatterplot showed that the points were evenly scattered around the line, indicating that the assumption of homoscedasticity was met. This adds confidence to the regression model used to examine the relationships between collaborative technology, social presence, and student engagement. Meeting this assumption ensures that the model's results are accurate, fair, and dependable. It also strengthens the findings that the combination of collaborative technology and social presence can effectively enhance student engagement in online learning environments.

Next is measuring the multicollinearity of the proposed model. The purpose of multicollinearity is to check if the independent variables are correlated with each other. Multicollinearity is a situation where independent variables in a regression model are highly correlated with each other. The existence of multicollinearity can make it difficult for the model to accurately estimate the individual effects of each independent variable. The presence of multicollinearity can distort the true relationship between the independent variables and the dependent variable that leading to incorrect conclusions. In short, multicollinearity can cause the regression coefficients to become unstable and unreliable. It can be determined by the value of tolerance (TOL) and the variance inflation factor (VIF) (Agronomic et al., 2024). According to Binti et al., (2021), the value of tolerance must be more than 0.1, and the value of VIF has to be less than 10. The values indicate that no multicollinearity exists in this case.

Next, the results of the multicollinearity test for this study are shown in Table 4.5, which presents the tolerance and Variance Inflation Factor (VIF) values for each independent variable. For both collaborative technology and social presence, the tolerance value is 0.444, and the VIF value is 2.251. Since all tolerance values are above 0.1 and all VIF values are below 10, it can be concluded that there is no multicollinearity between the independent variables. This means that collaborative technology and social presence are not too closely related and do not strongly overlap in what they measure. The absence of multicollinearity is important because it allows us to clearly understand the separate effect of each independent variable on student engagement. In other words,

we can more accurately identify how much collaborative technology and social presence each contributes to explaining changes in engagement.

Table 4.5
Multicollinearity Value of Tolerance (TOL) and Variance Inflation Factors (VIF)

Variables	Collinearity Statistics		Findings
	TOL	VIF	
Collaborative technology	0.444	2.251	No multicollinearity
Social Presence	0.444	2.251	No multicollinearity

From a technology integration perspective, this result supports the idea that while collaborative technology and social presence are related, they each represent unique aspects of the learning experience. Collaborative tools like online group projects or shared documents may support interaction and teamwork, while social presence relates more to how connected and supported students feel in the learning environment. The fact that both constructs are statistically independent strengthens the research model and shows that a combination of both elements can offer a fuller understanding of how technology enhances student engagement. This result adds credibility to the overall model and suggests that efforts to improve both areas can independently and positively influence learning outcomes. Overall, this study tested for multicollinearity to ensure collaborative technology and social presence are not too closely related. Results showed that tolerance and VIF values were within acceptable limits, meaning each variable provides unique information. This allows the model to measure how collaborative technology and social presence independently affect student engagement. The findings show that collaborative technology and social presence each play a distinct role in supporting student engagement, strengthening the research model, and making the results reliable.

4.3.5.2 Goodness of Fit of the Model

Goodness of Fit The Model is the evaluation of how well a statistical model represents a dataset. It measures how well the model's predictions or expected values match the actual observed data. The goodness of fit is a fundamental concept in statistics to evaluate the accuracy and effectiveness of the models. Assessing goodness of fit is crucial for evaluating the validity and usefulness of statistical models. Goodness of fit

of the regression model is assessed using the value of R-squared for multiple linear regression. R-squared is a statistical measure of how close the data are to the fitted regression line (Binti et al., 2022). The closer the value of R2 is to 1, the more significant the linearity and the more accurate and reliable the estimation results (Xu et al., 2022). The R-squared (R^2) value is used to show how well the independent variables explain the changes in the dependent variable. A value higher than 0.8 means the model has a strong fit, and the independent variables explain most of the variation. If the value is between 0.4 and 0.7, it indicates a moderate fit, meaning the variables explain a good portion of the variation, but not all. A value below 0.2 shows a weak fit, where only a small part of the variation is explained.

In this research, the results in Table 4.6 show that the Pearson correlation (R) for the model is 0.773, and the R^2 value is 0.598. This means that 59.8% of the total variation in student engagement is explained by collaborative technology and social presence. The remaining 40.2% is likely explained by other factors not included in the model. Since the R^2 value is between 0.4 and 0.7, it indicates a moderate model fit.

Table 4.6
R-squared of Test of Model Fit

R	**R^2**
0.773	0.598

This result suggests that collaborative technology and social presence play an important role in influencing student engagement, but they are not the only factors. Other elements such as teaching style, motivation, learning environment, or personal background may also contribute. The model still provides meaningful insight, especially within the context of educational technology. The moderate fit shows that technology-supported collaboration and social interaction have a significant impact on student engagement, which supports current research trends in digital learning environments. At the same time, it encourages future studies to explore additional variables to build a more complete picture of what drives engagement in technology-enhanced education. Overall, the goodness of fit shows that collaborative technology and social presence explain about 60% of student engagement, meaning they are important influences but not the only factors. The moderate R^2 indicates the model works well and provides meaningful insights into how technology and social connection

affect learning. These results make the model reliable and offer a strong foundation for further research.

4.3.5.3 Significance of the Model

The significance of the model refers to whether the model is statistically meaningful and useful to explain the relationship between variables. The results indicate the likelihood that the result of the model is not due to random chance. The significance of the model assumes that observed relationships between variables are not likely to have occurred by accident. It often involves defining independent variables as predictors and a dependent variable as the outcome. A significant model suggests that the independent variables in the model, if taken together, will have a meaningful impact on the dependent variable.

The results of the regression model, analyzed using Analysis of Variance (ANOVA), are shown in Table 4.7. The F-statistic is 371.614, and the p-value is less than 0.001. This very low p-value indicates that the overall regression model is statistically significant. In other words, the combination of collaborative technology and social presence has a meaningful impact on student engagement. This result suggests that when both factors are considered together, they significantly improve students' levels of engagement. The F-test confirms that the model explains enough of the variation in student engagement to be considered useful and reliable.

Table 4.7
Value of Significance of The Model

Sources of variation	**F statistics**	**Significant p-value**
Regression	371.614	< 0.001

From a technology-enhanced learning perspective, this finding highlights the importance of designing educational environments that not only include collaborative tools but also foster a strong sense of social presence. By synthesizing these results, it becomes clear that collaborative technology and social presence are not just useful on their own, but they work even better when combined. This supports the idea that creating interactive, socially rich digital learning spaces can greatly increase student involvement and participation. The ANOVA result strengthens the evidence for the research model and adds value to the growing body of literature on how integrated

technology strategies can enhance learning outcomes. Overall, the model is statistically significant, showing that collaborative technology and social presence together have a real and strong impact on student engagement. ANOVA results confirm the model is reliable and meaningful. Both collaborative technology and social presence boost engagement, but the greatest effect occurs when they are combined. This highlights that using collaborative tools and fostering social presence are key for effective technology-enhanced learning.

4.3.5.4Significance Variable Checking

Significance testing helps to determine whether a variable has a meaningful and statistically significant relationship with another variable in the model. If the p-value is less than 0.05, it means the result is unlikely to have happened by chance, and the variable is considered significant. ANOVA is commonly used for this purpose, and according to Niati et al. (2021), a p-value below 0.05 leads to the rejection of the null hypothesis, confirming that a real relationship exists. In this research, the significance test results for both independent variables, collaborative technology and social presence, are shown in Table 4.8. All p-values are less than 0.001, which means both variables have a statistically significant effect on student engagement. These results confirm that the relationship between the independent variables and the dependent variable is strong and meaningful.

Table 4.8
Value of Significant Variable Checking

Variables	B	Significant p-value	Finding
Constant	1.008	< 0.001	
Collaborative Technology	0.265	< 0.001	Significant
Social Presence	0.475	< 0.001	Significant

$y = 1.008 + 0.265\ (XI) + 0.475\ (X2)$

Student engagement = 1.008 + 0.265 (Collaborative technology) + 0.475 (Social presence)

This finding supports the idea that integrating collaborative tools and fostering social presence in educational settings can directly influence how engaged students feel. It also aligns with recent studies that highlight the importance of interaction,

communication, and technology in improving learning outcomes. By synthesizing these results, it can be concluded that both collaborative technology and social presence are essential parts of a successful learning environment. Their combined significance suggests that focusing on these areas can lead to higher student engagement, which is key to improving the quality of online or technology-supported education. Overall, significance testing shows that both collaborative technology and social presence have a real and strong impact on student engagement, with p-values below 0.001. This means the results are reliable and not due to chance. Using collaborative tools and fostering social presence together further enhances engagement, highlighting their key role in effective technology-supported learning.

4.4 Finalized Student Engagement Model

Based on the statistical analyses conducted, this research found strong evidence that both collaborative technology and social presence play significant roles in influencing student engagement in technology-supported learning environments. The reliability test showed that all variables had high Cronbach's alpha values (above 0.80), confirming that the measurement instruments were consistent and reliable. The normality test, including the P-P plot and skewness/kurtosis values, showed that the data were normally distributed. The scatter plot confirmed homoscedasticity, meaning the variance in residuals was consistent, while the multicollinearity test indicated no strong correlation between the independent variables, ensuring that each contributed uniquely to the model.

The correlation results showed strong positive relationships between collaborative technology, social presence, and student engagement. Both independent variables were significantly related to student engagement with p-values less than 0.001, showing that these relationships are unlikely due to chance. The R-squared value of 0.598 from the regression analysis indicated that around 59.8% of the variation in student engagement can be explained by collaborative technology and social presence. While this shows a moderate model fit, it still reflects a meaningful contribution. The ANOVA test further confirmed that the regression model was statistically significant, with a high F-value and $p < 0.001$. The final diagram of the proposed student engagement model is shown in Figure 4.6.

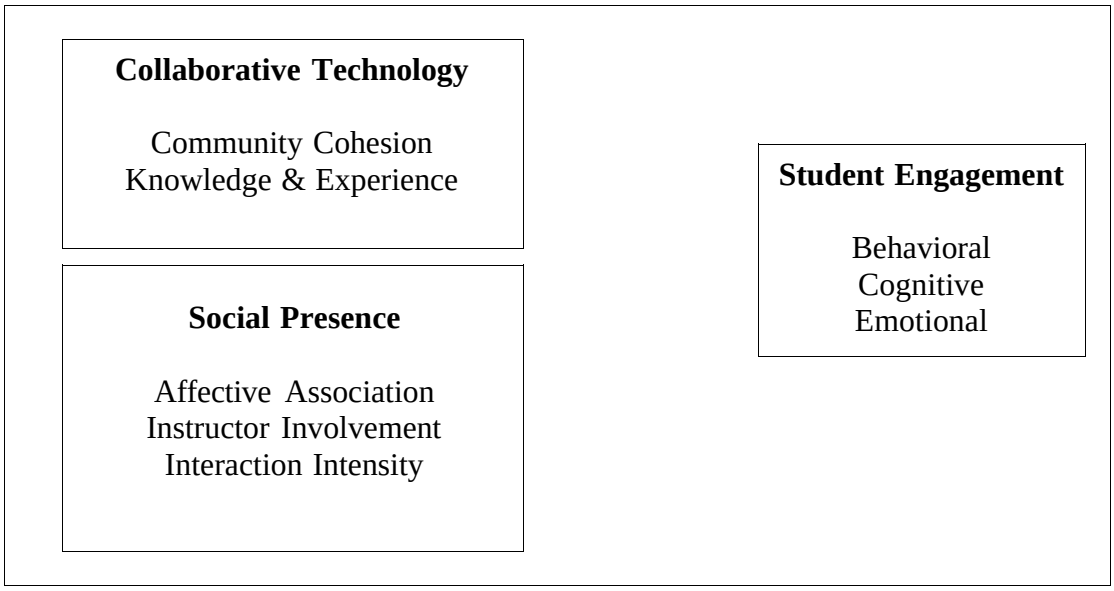


Figure 4.6 Student Engagement Model

In short, the findings support the proposed student engagement model and show that collaborative technology and social presence not only complement each other but also significantly improve student engagement when used together. These results reinforce the importance of designing learning environments that incorporate both technological tools for collaboration and strategies that enhance social interaction. The study contributes to current research in educational technology by providing empirical support for integrating these elements to create more engaging, connected, and effective learning experiences. Together, the results show that collaborative technology and social presence are important components of a successful technology-supported learning environment. Focusing on these areas can lead to higher student engagement, which is essential for improving the quality of online and digital education.

From the analysis of the student engagement model in this chapter, the study highlights the importance of social presence in improving student engagement. In support of social presence theory, which has been discussed in Chapter 2, social presence leads to the feeling of connectedness among students who actively participate by using an online environment. When collaborative technology is used together with social presence, student engagement can be improved even more. This interaction helps students feel seen, supported, and connected, which strengthens social presence. As a result, students are more willing to participate, share ideas, and stay involved in learning activities. This shows that collaborative technology supports social presence, and

together they play an important role in increasing student engagement in online learning.

When students sense that their peers and teachers are attentive and responsive, they are more motivated, confident, and willing to contribute to discussions and group activities. While collaborative technology provides the tools for interaction, it is the social connection created through social presence that makes students feel included and engaged. Essentially, social presence enhances the emotional and relational aspects of learning, which can have a greater impact on engagement than tools alone.

4.5 Chapter Summary

In summary, this research successfully designed and validated a Student Engagement Model for online learning that incorporates the use of collaborative technology. The findings confirmed that the proposed model is valid and suitable for evaluating student engagement in online learning environments, especially when both collaborative technology and social presence are considered. Through detailed analysis of respondents' demographic data and the relationships among the main variables, this research provided meaningful insights into students' experiences with online learning. The research explored how students interact with collaborative tools and how the presence of others in an online space (social presence) contributes to their engagement. The results showed that both collaborative technology and social presence have a significant positive relationship with student engagement, suggesting that these factors play an important role in keeping students motivated and involved in their learning activities. This confirms that the integration of technology and social interaction elements can enhance students' engagement in online learning, making the model a valuable framework for future research and practical application in digital education settings.

The next chapter presents the contributions of this research, including its impact on educational practice, theory, and future studies. This is followed by the conclusion, which summarizes the overall outcomes of the research. Lastly, the chapter will provide recommendations for future research, offering suggestions for improving and expanding the current research to further explore student engagement in online learning environments.

CHAPTER 5
CONCLUSION

5.1 Introduction

This chapter presents the conclusion of the research by summarizing the overall findings and how they relate to the research objectives. It provides a brief recap of the research process, from the development of the Student Engagement Model to the analysis of data collected from students with online learning experience. The chapter also highlights the outcomes that support the model's validity and relevance in the context of collaborative technology and social presence. In addition, this chapter offers practical recommendations and suggestions based on the results of the research. These recommendations are intended to guide educators, researchers, and institutions in improving student engagement in online learning environments. Lastly, this chapter suggests possible directions for future research to further explore and enhance the understanding of student engagement in digital learning contexts.

5.2 Revisit of Research Objectives

This research aimed to examine how collaborative technology and social presence influence student engagement among secondary school students in Malaysia. Specifically, the research objectives were:

Table 5.1
Deliverables for research objectives

Research objectives	Deliverables	Chapter
To explore the existing models for collaborative technology usage of online learning in Malaysia context.	List of related and most used frameworks and models regarding student engagement and social presence	Chapter 2
To design a student engagement model for collaborative technology with social presence theory in online learning.	An enhanced student engagement model	Chapter 3
To validate the student engagement model for collaborative technology usage in online learning using Multiple Linear Regression.	Validated enhanced student engagement model	Chapter 4

As can be seen from Table 5.1, research objective 1 is achieved in Chapter 2, while research objective 2 is achieved in Chapter 3, and research objective 3 is achieved in Chapter 4. The findings of this research show that students' engagement levels in online learning depend on how collaborative tools are used and the sense of social connection they feel. Collaborative technology helps students interact, communicate, and work together, while social presence makes them feel included, supported, and connected. Both collaborative technology and social presence have significant positive effects on student engagement. This research also validates the enhanced Student Engagement Model (SEM) using reliable survey data showing that collaborative technology and social presence together improve engagement in technology-supported learning. Overall, these results confirm that the research objectives have been met and provide useful insights for improving digital learning practices in Malaysian secondary schools.

5.3 Research Contribution

The findings of this research have contributed to the field of educational research, especially in the area of technology-enhanced learning. These contributions can be grouped into three key areas: theoretical, methodological, and practical. A summary of these contributions, based on each research objective, is presented in Table 5.2 for easier reference.

From a theoretical point of view, this research has introduced an enhanced model of student engagement that is specifically designed for online learning environments. The model includes two important elements, collaborative technology and social presence, as the main factors that influence student engagement. It is built upon a detailed review of previous research and offers a clearer understanding of how students stay engaged in virtual learning settings. This model is valuable because it offers a new perspective and structure for future researchers.

From a methodological perspective, this research applied a quantitative research approach using statistical tools such as SPSS and multiple linear regression to test and validate the model. By carrying out reliability tests, correlation analysis, and regression analysis, the research showed that the model is statistically sound and reliable. This process not only supports the use of the model in educational studies but also serves as a useful guide for researchers who want to study similar topics or apply the same techniques in different settings.

From a practical perspective, this research provides a useful tool for measuring student engagement, especially in an online learning context. While the research was conducted among secondary school students in Kelantan, the model can potentially be used in other education levels and learning environments. This means that teachers, school leaders, and institutions can use the model to better understand how students engage in online learning and find ways to improve that engagement through the use of collaborative tools and social interaction.

Regarding generalizability, although all respondents are from Kelantan, the characteristics of students in Kelantan are similar to those in other East Coast states. Therefore, the results can be cautiously applied to groups with similar profiles. The study does not aim to generalize findings to the entire national or global population, but rather to perform analytical generalization, meaning the conclusions can be extended to settings that share similar characteristics. In simple terms, it means that this research is not trying to make conclusions that apply to every student in the population (statistical generalization). Instead, it aims to provide insights and understanding that can be applied to similar situations or groups (analytical generalization). The focus is on understanding patterns, relationships, and how the model works, so the findings can be used in settings that share similar characteristics.

Table 5.2
Summary of Research Contribution

Research Objectives	Research Questions	Analysis Technique	Contribution Type	Research Contribution
To explore the existing models for collaborative technology usage of online learning in Malaysia context.	What are the existing models that determine student engagement in using collaborative technology of online learning in Malaysia?	Literature Review Analysis Paper Review	Theoretical	Developed an enhanced model of student engagement that integrates collaborative technology and social presence. This model contributes to theory by offering a new perspective on how engagement can be understood and measured in digital learning.
To design a student engagement model for collaborative technology with social presence theory in online learning.	What is a suitable model for measuring student engagement in using collaborative technology in online learning?	Pilot study Reliability Analysis Pearson Correlation Test	Methodological	Preliminary analysis of the enhanced Student Engagement Model using statistical methods (SPSS) confirms that the constructs are reliable and normally distributed. Offers a clear method for evaluating similar models in future research.
To validate the student engagement model for collaborative technology usage in online learning using Multiple	How is the model validated for collaborative technology usage in online learning?	Multiple Linear Regression by analysing: Model Adequacy Checking, Goodness of Fit of Model, Significance of the Model, Significance Variable	Practical/applied	An enhanced Student Engagement model that has been validated by using statistical analysis. The model can be used to measure engagement in real learning environments that has the same characteristics and is potentially adaptable to different academic levels, offering value to educators and practitioners.

Linear Regression. Checkin

Moreover, this research makes an important contribution to the field of Information Technology (IT) by linking concepts from education with the practical use of technology in online learning environments. This research has developed and tested a new model of student engagement, which includes two key elements: collaborative technology and social presence. This model helps explain how digital tools such as online discussion forums, video conferencing platforms, and shared digital workspaces can play a major role in increasing student participation and involvement in online learning. The findings of this research can support IT professionals, system designers, and software developers in creating online learning platforms that are more interactive, engaging, and user-friendly. For example, the research shows that features that allow students to communicate, collaborate, and feel socially connected can lead to higher engagement. This means that IT teams working on e-learning systems can use the model as a reference to design platforms that support these functions effectively. Including such features in the design stage can help improve the overall learning experience and promote better outcomes for students.

Furthermore, this research also shows how IT-related studies can benefit from data-driven approaches. By using methods such as multiple linear regression, reliability analysis, and descriptive statistics, the research offers an example of how data can be used to better understand how people interact with digital technologies. These methods allow researchers and developers to make informed decisions based on evidence, which can lead to more efficient and impactful technology solutions in the field of education. In summary, this research links educational needs with technological solutions, offering both theoretical insights and practical tools that can guide future developments in online learning systems.

5.4 Research Summary

Generally, this research was conducted to investigate the factors that influence student engagement in an online learning environment by the use of collaborative technology. The factors were gathered while performing a literature review on student engagement issues. Besides, the factors found were formed as the proposed research model for measuring student engagement in different dimensions. Basically, this research aimed to come out with a new model that can be used to assess the level of engagement towards students' learning during online learning sessions. The model

involves different factors as the independent variables, which are collaborative technology and social presence, while the dependent variable is student engagement. Besides, the proposed model was analysed using analytical SPSS software.

This research aims to achieve two objectives, which are to find the factors influencing student engagement to design and develop a new model, and to validate whether the model is reliable to be use. After all, this research successfully achieved both objectives. As proof, this research conducts an analysis using multiple linear regression to examine the usability of the research outcomes. To briefly explain, the first and second objectives were achieved by performing a literature review, and the third objectives were achieved by the findings analysis. Besides, this research was conducted among secondary school students in Kelantan according to their experience in online learning with the use of collaborative technology, and the sample was randomly chosen. Lastly, the proposed model of this research cannot only be used for secondary school students but is also applicable to all levels since student engagement is related to all academic levels. To easily understand how the research objectives are achieved, Table 5.1 shows a summary of the analysis method used to achieve each of the objectives and what are the contribution from this research according to the research objectives.

5.5 Limitations and Recommendations

Despite the valuable contributions of this research, several limitations should be acknowledged. First, the sample in this research excluded students with special needs or disabilities. As a result, the findings and the proposed model may not fully represent the engagement patterns or learning experiences of students with different learning abilities or accessibility needs. Future research should aim to include a more diverse population, including students with physical, cognitive, or learning disabilities, to ensure broader applicability and inclusiveness of the model.

Second, the research was limited to secondary school students in Kelantan aged between 13 and 15 years. This narrow demographic focus may limit the generalizability of the findings to other age groups, educational levels, or geographic regions. Future studies could involve participants from different states, school types (urban and rural), or even higher education institutions to explore whether the model holds across various contexts. Third, the research examined student engagement from a general learning

perspective and did not focus on specific subjects such as mathematics, science, or language learning. However, engagement levels may differ across disciplines due to varying content difficulty, teaching styles, or types of interaction involved. Future studies could explore how subject-specific factors influence engagement in technology-supported environments.

In addition, while this research validates the engagement model for students without learning difficulties, it does not explore potential adaptations that may be necessary for other learner groups. Further research could investigate whether additional variables such as motivation, digital literacy, or parental support are relevant for specific student populations. Overall, while this research successfully developed and validated a reliable model of student engagement in online learning using collaborative technology, future research should expand the scope to ensure the model is more inclusive, context-sensitive, and adaptable to different educational needs and settings.

Based on the limitations of this research, several directions for future research are suggested. Firstly, future studies could be initiated by involving students as respondents from different age groups to explore how maturity, digital skills, and learning habits influence engagement with collaborative technology. Secondly, future research could be expanded for other categories of schools, such as MRSM, SBP, technical schools, special education schools, and private schools, to provide a more comprehensive understanding of student engagement across diverse educational settings. Thirdly, future studies could include students with disabilities to examine how collaborative technology can support their learning, as their needs and engagement patterns may differ from 'Arus Perdana' students. Finally, in order to have more extensive analysis for the Malaysian context, the research could be extended to other states in Malaysia to compare engagement levels and challenges in different regional contexts. After testing the student engagement model in different states in Malaysia, it could also be applied in other countries. However, each country has different cultures, education systems, and access to technology, which can affect how students engage in online learning. Future research should study this model in other countries to see if it works in different settings. This would make the model stronger and more useful for online learning worldwide.

REFERENCES

Abdi, S. J. (2023). *A Comprehensive Guide for Selecting Appropriate Statistical Tests: Understanding When to Use Parametric and Nonpar•ametric Tests.* 464-474. https://doi.org/10.4236/ojs.2023.134023

Abuhassna, H., Busalim, A., Yahaya, N., Zakaria, M. A. Z. M., & Latif, A. B. A. (2023). Study From Home! the Antecedents and Consequences of Collaborative Learning on Malaysian University Students. *Journal of Information Technology Education: Research, 22,* 71-95. https://doi.org/10.28945/5074

Adiyono, A., Hayat, E. W., Oktavia, E. D., & Prasetiyo, N. T. (2024). Learning interaction in the digital era: Technological innovations and education management strategies to enhance student engagement. *Journal of Research in Instructional, 4(1),* 205-221. https://doi.org/10.30862/jri.v4il.333

Agronomic, E., Influencing, F., Yield, C, Regression, M., & Validation, M. (2024). *International Journal of Agricultural Extension EVALUATING AGRONOMIC FACTORS INFLUENCING COTTON YIELD USING.* 72(03), 379-388. https://doi.org/10.33687/ijae.012.003.5418

Ahmed, N. H, Andersion, J., & Martinez, A. G. (2025). *Innovative Blended Learning Approaches to Enhance Student Engagement in University.* 7(1), 1-21.

Ahmed, S. K. (2024). How to choose a sampling technique and determine sample size for research: A simplified guide for researchers. *Oral Oncology Reports,* 72(September), 100662. https://doi.Org/10.1016/j.oor.2024.100662

Akpomi, M. E. (2023). *Artificial Intelligence , Robotics, and Information Communication Technologies: Tools for Enhancing Business and Educational Management.* 2(1), 21-29.

Aksak Komur, 1, Kihnc, H, & Okur, R. (2023). The Rotation Model in Blended Learning. *Asian Journal of Distance Education,* 75(2), 63. http://www.asianjde.com/

Al-naabi, I., & Cifuentes-faura, J. (2023). *Exploring Cross-Cultural Teacher Perspectives on Student Engagement in Virtual Learning Environments During The COVID-19 Pandemic Exploring Cross-Cultural Teacher Perspectives on Student Engagement in Virtual. 20(1).*

Alam, A., & Mohanty, A. (2024). Framework of Self-Regulated Cognitive Engagement (FSRCE) for sustainable pedagogy : a model that integrates SRL

and cognitive engagement for holistic development of students sustainable pedagogy : a model that integrates SRL and cognitive. *Cogent Education*, 77(1). https://doi.org/10.1080/2331186X.2024.2363157

Alamsyah, M. N, & Nuha, M. S. (2024). *Learning Engagement; Definition , Aspects , Measurement and Intervention Strategies.* (5(1), 13-18. https://doi.org/10.31960/konseling.v6il.2364

Alenezi, M., Wardat, S., & Akour, M. (2023). The Need of Integrating Digital Education in Higher Education: Challenges and Opportunities. *Sustainability (Switzerland),* 75(6), 1-12. https://doi.org/10.3390/sul5064782

Alfares, N. (2024). Is synchronous online learning more beneficial than asynchronous online learning in a Saudi EFL setting: teachers' perspectives. *Frontiers in Education,* P(October), 1-15. https://doi.org/10.3389/feduc.2024.1454892

Altwijri, O., Alsadoon, E., Shahba, A. A., Soufan, W., & Alkathiri, S. (2022). *The Effect of Using " Student Response Systems (SRS) " on Faculty Performance and Student Interaction in the Classroom.*

Alviar, J. V., & Gamorez, A. E. (2024). Effects of classroom response system on the achievement and knowledge retention of the students in mathematics. *Cogent Education,* 77(1). https://doi.org/10.1080/2331186X.2024.2323364

Alyami, A., Pileggi, S. F., & Hawryszkiewycz, I. (2023). Knowledge development, technology and quality of experience in collaborative learning: a perspective from Saudi Arabia universities. *Quality and Quantity,* 57(4), 3085-3104. https://doi.org/10.1007/slll35-022-01476-9

Aman Deep Singh, & Bhuyan, K. N. (2024). Collaborative Teaching-Learning in Classroom Research Based Setting and Its Impact. *Ayarj,* 75(1), 37-48.

Andrin, G, Kilag, O. K., Groenewald, E., Benitez, J., Dagala, F., & Ubay, R. (2024). Borderless Learning Environments: Impacts on Educational Management Strategies. *International Multidisciplinary Journal of Research for Innovation, Sustainability, and Excellence (IMJRISE),* 7(2), 43-49. https://risejournals.org/index.php/imjrise/article/view/41

Bai, X., Virginia, N., & College, C. (2023). *Practical activities to engage students in face-to-face and synchronous online teaching environments. 24(3),* 105-115.

Baker, S., Watkinson, M. G., Honeyman, F., & Mowll, J. (2024). Rethinking student engagement for ' hyflex ' teaching and learning in post-compulsory settings : acknowledging flexibility and agency needed for unplanned events. *International*

Journal of Lifelong Education, 43(4), 432-447. https://doi.org/10.1080/02601370.2024.2359595

Bali, S., Liu, M.-C, & Sari, H. (2024). Examining Key Determinants of Social Presence and Satisfaction in Online Learning: An Exploration with Undergraduate Student. *International Journal of Education in Mathematics, Science and Technology, 12(4),* 1071-1089. https://doi.org/10.46328/ijemst.4095

Bait, E. (2023). Open Access Child and Adolescent Psychiatry and Mental Health. *Child and Adolescent Psychiatry and Mental Health, 17,* 48. http://creativecommons.Org/licenses/by/4.0/.TheCreativeCommonsPublicDomain Dedicationwaiver%0Ahttp://creativecommons.org/publicdomain/zero/1.0/

Baxter, G., & Hainey, T. (2023). Remote learning in the context of COVID-19: reviewing the effectiveness of synchronous online delivery. *Journal of Research in Innovative Teaching and Learning, 16(1),* 67-81. https://doi.org/10.1108/JRIT-12-2021-0086

Bedi, A. (2023). Keep Learning: Student Engagement in an Online Environment. *Online Learning Journal, 27(2),* 119-136. https://doi.org/10.24059/olj.v27i2.3287

Bekker, C. I., Rothmann, S., & Kloppers, M. M. (2023). The happy learner: Effects of academic boredom, burnout, and engagement. *Frontiers in Psychology,* 73(January), 1-14. https://doi.org/10.3389/fpsyg.2022.974486

Biradar, S. (2025). *Web 2 . 0 features: An effective use in academic library websites. September 2024.*

Bisarya, S. S. (2023). *AGRICULTURAL EXTENSION(VOLUME -. January.*

Bond, M., & Bergdahl, N. (2022). Student Engagement in Open, Distance, and Digital Education. *Handbook of Open, Distance and Digital Education,* 1-16. https://doi.org/10.1007/978-981-19-0351-9_79-l

Borup, J., Graham, C, West, R., Archambault, L., & Shin, J. (2023). Academic Communities of Engagement (ACE) Framework. *EdTechnica.* https://doi.org/10.59668/371.12259

Brandstrup, C, Katajavaara, I., Beck, A., Petrine, C, Bjerregaard, P., Viskum, C, & Larsen, L. (2024). Child Abuse & Neglect Developing the ACEIG-scale : An adverse childhood experience scale for Inuit youth in Greenland. *Child Abuse & Neglect, 148(My* 2023), 106471. https://doi.org/10.1016/jxhiabu.2023.106471

Burgund, D., & Nikolovski, S. (2023). *Pearson Correlation in Determination of*

Quality of Current Transformers.

Bursa, S. (2023). the View of Prospective Social Studies Teachers on Blended Learning. *Turkish Online Journal of Distance Education, 24(1),* 185-199. https://doi.org/10.17718/tojde.1018486

Carroll, N, Lang, M., Connolly, C, & Lang, M. (2025). An extended community of inquiry framework supporting students in online and digital education. *Innovations in Education and Teaching International, 62(2),* 369-385. https://doi.org/10.1080/14703297.2024.2326658

Chamorro-Atalaya, O., Marcelo-Veliz, B., Morales-Romero, G., Trinidad-Loli, N., Villar-Valenzuela, D., Caycho-Salas, B., & Leon-Velarde, C. (2022). Collaborative learning through virtual tools: Analysis of the perception of student satisfaction of teaching performance. *Indonesian Journal of Electrical Engineering and Computer Science, 26(2),* 1082-1090. https://doi.org/10.11591/ijeecs.v26.i2.ppl082-1090

Chan, J. Y., Mun, S., Leow, H., Bea, K. T., Cheng, W. K., Phoong, S. W., Hong, Z., & Chen, Y. (2022). *Mitigating the Multicollinearity Problem and Its Machine Learning Approach : A Review.*

Chisunum, J. I., & Nwadiokwu, C. N. (2024). *Enhancing Student Engagement through Practical Production and Utilization of Instructional Materials in an Educational Technology Class: A MultifacetedApproach. 10(2),* 81-89.

Clarke, M., & Zhao, A. X. (2023). EUR Research Information Portal Dependency Theory. In *EdwardElgar Publishing* (Issue Cc).

Cumbest, C. K. (2022). *THE IMPACT OF PROFESSIONAL DEVELOPMENT ON TRAUMA INFORMED PRACTICES (TIPs) IN A TEACHER'S FEELING OF SELF-EFFICACY by.*

Davidson-Shivers, G., & Rand, A. (2023). Asynchronous Tools for Interaction and Collaboration. *Handbook of Open, Distance and Digital Education,* 1003-1020. https://doi.org/10.1007/978-981-19-2080-6_56

De Bruijn-Smolders, M., & Prinsen, F. R. (2024). Effective student engagement with blended learning: A systematic review. *Heliyon, 10(23),* e39439. https://doi.Org/10.1016/j.heliyon.2024.e39439

DEMIR, S. (2022). Comparison of Normality Tests in Terms of Sample Sizes under Different Skewness and Kurtosis Coefficients. *International Journal of Assessment Tools in Education, 9(2),* 397-409.

https://doi.org/10.21449/ijate.1101295

Derakhshan, A., Fathi, J., Pawlak, M., & Kruk, M. (2022). Classroom social climate, growth language mindset, and student engagement: the mediating role of boredom in learning English as a foreign language. *Journal of Multilingual and Multicultural Development, November 2024,* 1-19. https://doi.org/10.1080/01434632.2022.2099407

Deschenes, A. A. (2024). Digital literacy, the use of collaborative technologies, and perceived social proximity in a hybrid work environment: Technology as a social binder. *Computers in Human Behavior Reports,* 73(May 2023). https://doi.Org/10.1016/j.chbr.2023.100351

Dieu, N. B. (2024). *ENHANCING STUDENT ENGAGEMENT AND AUTONOMY IN FLIPPED CLASSROOMS: FROM A SELF-DETERMINATION THEORY PERSPECTIVE NANG CAO SLfHUNG THU VA TlfHOC CUA NGUOIHOC TRONGMO HINHLOP HOC DAO NGUOC: TlfGOC DO HOC THUYET Tlf QUYET*. 32-37.

Dunmoye, ID., Rukangu, A., May, D., & Das, R. P. (2024). Computers & Education : X Reality An exploratory study of social presence and cognitive engagement association in a collaborative virtual reality learning environment. *Computers & Education: XReality,* -/(January), 100054. https://doi.org/10.1016/jxexr.2024.100054

Fang, K., Li, L., & Wu, Y. (2023). Research on student engagement in distance learning in sustainability science to design an online intelligent assessment system. *Frontiers in Psychology,* /-/(November), 1-13. https://doi.org/10.3389/fpsyg.2023.1282386

Faro, M. H., Gutu, T. S., & Hunde, A. B. (2025). Major factors influencing student engagement in Ethiopian higher education institutions: Evidence from one institution. *PLoS ONE, 20(2* February), 1-22. https://doi.org/10.1371/journal.pone.0318731

Fatokun, J. O. (2024). *EXPLORING STUDENTS ' PERCEPTION OF ENGAGEMENT IN FACE-TO-FACE AND ONLINE TEACHING. 6,* 62-72. https://doi.org/10.21303/2504-5571.2024.003701

Fenteng, A. (2023). Online Learning: A Cognitive Tool for Learning, an Alternative to Traditional Learning Style. *Psychology, 14(05),* 676-686. https://doi.org/10.4236/psych.2023.145036

Fischer-Suarez, N., Lozano-Paniagua, D., Garcia-Gonzalez, J., Castro-Luna, G., Requena-Mullor, M., Alarcon-Rodriguez, R., Parron-Carrefio, T., & Nievas-Soriano, B. J. (2022). Use of Digital Technology as a Collaborative Tool among Nursing Students—Survey Study and Validation. *International Journal of Environmental Research and Public Health, 19(21).* https://doi.org/10.3390/ijerphl92114267

Fleckenstein, J., Jansen, T., Meyer, J., Triib, R., Raubach, E. E., & Keller, S. D. (2024). How am I going ? Behavioral engagement mediates the effect of individual feedback on writing performance. *Learning and Instruction,* 93(July), 101977. https://doi.Org/10.1016/j.learninstruc.2024.101977

Garlinska, M., Osial, M., Proniewska, K., & Pregowska, A. (2023). The Influence of Emerging Technologies on Distance Education. *Electronics (Switzerland), 12(1).* https://doi.org/10.3390/electronicsl2071550

Ghanad, A. (2023). *An Overview of Quantitative Research Methods.* 0(5(08), 3794-3803. https://doi.org/10.47191/ijmra/v6-i8-52

Ghavifekr, S., & Wong, S. Y. (2022). Technology leadership in Malaysian schools: The way forward to education 4.0 - ICT utilization and digital transformation. *International Journal of Asian Business and Information Management, 13(2),* 1-18. https://doi.org/10.4018/IJABIM.20220701.oa3

Ghelani, D., & Hua, T. K. (2022). *Conceptual Framework of Web 3 . 0 and Impact on Marketing, Artificial Intelligence , andBlockchain. May.* https://doi.Org/10.11648/j.ijics.20220701.12

Gomes, S., Costa, L., Martinho, C, Dias, J., Xexeo, G, & Santos, A. M. (2023). Modeling students ' behavioral engagement through different in - class behavior styles. *International Journal of STEM Education.* https://doi.org/10.1186/s40594-023-00407-w

Gopinathan, S., Kaur, A. H., Veeraya, S., & Raman, M. (2022). The Role of Digital Collaboration in Student Engagement towards Enhancing Student Participation during COVID-19. *Sustainability (Switzerland), 14(11).* https://doi.org/10.3390/sul4116844

Guerrero, A. J., Bedoya, M. C, Mosquera, E. F., Ango, E. D., & Lara, R. M. (2023). Hybrid Education: Current Challenges. *Ibero-American Journal of Education & Society Research, 3(1),* 276-279. https://doi.org/10.56183/iberoeds.v3il.629

Guzik, P., & Wieckowska, B. (2023). *Data distribution analysis - a preliminary*

approach to quantitative data in biomedical research. 92(2), 81-96. https://doi.org/10.20883/medical.e869

Hatem, G, Zeidan, J., Goossens, M., & Moreira, C. (2022). *NORMALITY TESTING METHODS AND THE IMPORTANCE OF. 3(2).*

Hew, Khe Foon, W. H. (2023). *Promoting engagement in online learning beyond COVID-19 -Possible strategies and directions for future research.pdf*

Hidayati, A. (2023). *Strategies for integrating a web-based learning environment based on authentic learning in distance learning for elementary school students.* 70(3), 437-445. https://doi.org/10.20448/jeelr.vl0i3.4840

Ho, K., & Tang, D. (2024). *Implications of Artificial Intelligence for Teaching and Learning.* 3(21), 65-79.

Hoerudin, C. W., Syafmddin, S., Mayasari, A., Arifudin, O., & Lestari, S. (2023). E-Learning as A Learning Media Innovation Islamic Education. *QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama,* 75(1), 723-734. https://doi.org/10.37680/qalamuna.vl5il.4466

Hotara, N., Ozcanb, M. A., Baranc, B., Karagozd, E., & Liitfiye Ozge Giineye*. (2023). Face-to-Face, Online or Hybrid, Which Model is Preferred by University Students And Why? *Journal of Learning and Teaching in Digital Age, 8(2),* 176-186. https://doi.org/10.53850/joltida.1125339

Hou, D. (2023). Constructing and Realizing a Model of College Students' Learning Engagement Strategy Based on Factor Analysis. *Proceedings of the 2nd International Conference on Internet, Education and Information Technology (IEIT2022),* 390-397. https://doi.org/10.2991/978-94-6463-058-9_64

Huang, Y., & Wang, S. (2023). How to motivate student engagement in emergency online learning? Evidence from the COVID-19 situation. *Higher Education, 85(5),* 1101-1123. https://doi.org/10.1007/sl0734-022-00880-2

Hung, C. T., Wu, S. E., Chen, Y. H, Soong, C. Y., Chiang, C, & Wang, W. (2024). The evaluation of synchronous and asynchronous online learning: student experience, learning outcomes, and cognitive load. *BMC Medical Education, 24(\),* 1-8. https://doi.org/10.1186/sl2909-024-05311-7

Ilmiah, J., Terapan, I., Jambi, U., Hidayat, R., Khairul, M., Imami, W., Saad, R. M., Liu, S., Qudratuddarsi, H., & Info, A. (2024). *VALIDITY OF ENGAGEMENT INSTRUMENT DURING ONLINE LEARNING IN. 8(2),* 467-484.

Indra, M. H., Sutarto, S., Kharizmi, M., Nurmiati, A. S., & Susanto, A. (2023).

Optimizing the Potential of Technology-Based Learning Increases Student Engagement. *Al-Fikrah: JurnalManajemen Pendidikan, 11(2),* 233. https://doi.org/10.31958/jaf.vlli2.10554

Indriyani, V., Jasmienti, & Fendi, H. (2024). Asynchronous vs Synchronous: Effects of Online Learning on Students' Oral Presentation Skills. *Journal of Education Technology*, 5(1), 165-174. https://doi.org/10.23887/jet.v8il.67113

Istijanto, & Nathalie, C. C. (2024). Factors influencing student engagement and intention to attend lectures. *Cogent Education, 11(1).* https://doi.org/10.1080/2331186X.2024.2415287

Izah, S. C, Sylva, L., & Hait, M. (2024). Cronbach's Alpha: A Cornerstone in Ensuring Reliability and Validity in Environmental Health Assessment. *ES Energy and Environment, 23,* 1-14. https://doi.org/10.30919/eseel057

James, W., Oates, G., & Schonfeldt, N. (2024). Improving retention while enhancing student engagement and learning outcomes using gamified mobile technology. *Accounting Education, 9284,* 1-21. https://doi.org/10.1080/09639284.2024.2326009

Jeppu, A. K., Kumar, K. A., & Sethi, A. (2023). ' We work together as a group ': implications of jigsaw cooperative learning. *BMC Medical Education,* 1-8. https://doi.org/10.1186/sl2909-023-04734-y

Jin, S. H., Im, K., Yoo, M., Roll, I., & Seo, K. (2023). Supporting students' self-regulated learning in online learning using artificial intelligence applications. *International Journal of Educational Technology in Higher Education, 20(1).* https://doi.org/10.1186/s41239-023-00406-5

Johar, N. A., Kew, S. N., Tasir, Z., & Koh, E. (2023). Learning Analytics on Student Engagement to Enhance Students' Learning Performance: A Systematic Review. *Sustainability (Switzerland),* 75(10), 1-25. https://doi.org/10.3390/sul5107849

Jou, Y. (2024). *The Application of Cooperative Learning in Novel Teaching.* 25(1), 25-44. https://doi.org/10.15354/sief.24.re423

Jovanovic, A., & Milosavljevic, A. (2022). Usabilidad en aplicaciones moviles. Informes Cientificos Tecnicos. *Electronics (Switzerland), 11(3).*

Kaiser, L., McKenna, K., Lopes, T., & Zarestky, J. (2023). Strategies for supporting adult working learners in the online learning environment. *New Directions for Adult and Continuing Education, 2023(179),* 53-65. https://doi.org/10.1002/ace.20502

Kaliisa, R., Rienties, B., M0rch, A. I., & Kluge, A. (2022). Social learning analytics in computer-supported collaborative learning environments: A systematic review of empirical studies. *Computers and Education Open,* ^(January), 100073. https://doi.org/10.1016/jxaeo.2022.100073

Kamel, A. R., & Abonazel, M. R. (2023). *A Simple Introduction to Regression Modeling using R.* 2(February), 52-79. https://doi.org/10.21608/cjmss.2023.189834.1002

Kassab, S. E., Al-Eraky, M., El-Sayed, W., Hamdy, H., & Schmidt, H. (2023). Measurement of student engagement in health professions education: a review of literature. *BMC Medical Education,* 23(1), 1-13. https://doi.org/10.1186/sl2909-023-04344-8

Kassab SE, El-Sayed W, H. H. (2023). *Student engagement in undergraduate medical education: a scoping review* (Issue Cc).

Kennedy, I. (2022). *No Title.* 2(1), 17-29. https://doi.org/10.52589/BJCE-FY266HK9

Kiyancicek, E. (2022). *Gamification in English Language Classrooms: The Case of Kahoot! Gamification in English Language Classrooms: The Case o/Kahoot! Ingilizce Dil Siniflannda Oyunlastirma: Kahoot! Ornegi Makale Bilgisi Oz.* 0-13.

Kristiana, I. F., Prihatsanti, U., & Simanjuntak, E. (2024). *International Review of Research in Open and Distributed Learning Online Student Engagement: The Overview of HE in Indonesia Online Student Engagement: The Overview of HE in Indonesia Abstract.* 33-53.

Kuhlmann, S. L., Plumley, R., Evans, Z., Bernacki, M. L., Greene, A., Hogan, K. A., Berro, M., Gates, K., Panter, A., & Carolina, N. (2024). Computers & Education Students ' active cognitive engagement with instructional videos predicts STEM learning. *Computers & Education,* 2/<5(March 2023), 105050. https://doi.Org/10.1016/j.compedu.2024.105050

Kumar, V. (2023). *Peer-supported Independent Study (psis) - an Effective Model for Enhancing Student Engagement and Optimizing Class Time in Engineering Courses - A Case Study From India. 36(3).*

Lasekan, O. A., Pachava, V., Godoy Pena, M. T., Golla, S. K., & Raje, M. S. (2024). Investigating Factors Influencing Students' Engagement in Sustainable Online Education. *Sustainability (Switzerland), 16(2),* 1-15. https://doi.org/10.3390/sul6020689

Leblanc, J. A. (2025). *High School Chemistry Teachers' Perceptions ofCRS Technologies on Academic Motivation, Engagement, and Enhanced Learning.*

Lestrade, K., Lima, L., & Pansu, P. (2025). *Challenges and Opportunities of Cooperative Learning in Synchronous Distance Education among Adolescent and Young Adult Learners.* 77(1). https://doi.org/10.18178/ijlt.ll.L16-23

Li, D. (2022). *The Shift to Online Classes During the Covid-19 Pandemic : Benefits, Challenges, and Required Improvements from the Students 'Perspective. 20(\),* 1-18.

Li, L. (2022). Students' Isolation Challenges in Blended EFL Learning During COVID-19: How Can Social Presence and Interaction Help Develop Sense of Community? *Psychology Research and Behavior Management,* 75, 3117-3131. https://doi.org/10.2147/PRBM.S388317

Lombardi, D., Shipley, T. F., Bailey, J. M., Bretones, P. S., Prather, E. E., Ballen, C. J., Knight, J. K., Smith, M. K., Stowe, R. L., Cooper, M. M., Prince, M., Atit, K., Uttal, D. H., LaDue, N. D., McNeal, P. M., Ryker, K., St. John, K., van der Hoeven Kraft, K. J., & Docktor, J. L. (2021). The Curious Construct of Active Learning. *Psychological Science in the Public Interest, 22{X),* 8-43. https://doi.org/10.1177/1529100620973974

Lopez, E. G., & Cabot, A. G. (2022). *Implications of using classroom response systems (CRS) on learning performance : An experience oflearning analytics. October 2021,* 1161-1174. https://doi.org/10.1002/cae.22512

Luh, W. M. (2024). A General Framework for Planning the Number of Items/ Subjects for Evaluating Cronbach's Alpha: Integration of Hypothesis Testing and Confidence Intervals. *Methodology, 20(\),* 1-21. https://doi.org/10.5964/meth.10449

Ma, S., & Chen, Y. (2024). *The impacts of learning motivation , emotional engagement and psychological capital on academic performance in a blended learning university course. May,* 1-12. https://doi.org/10.3389/fpsyg.2024.1357936

MacNeill, H., Masters, K., Nemethy, K., & Correia, R. (2024). Online learning in Health Professions Education. Part 1: Teaching and learning in online environments: AMEE Guide No. 161. *Medical Teacher, 46{X),* 4-17. https://doi.org/10.1080/0142159X.2023.2197135

Macneill, H., Masters, K., Nemethy, K., Correia, R., Macneill, H., Masters, K., &

Nemethy, K. (2024). Online learning in Health Professions Education . Part 1 : Teaching and learning in online environments : AMEE Guide No .161. *Medical Teacher, 46(1),* 4-17. https://doi.org/10.1080/0142159X.2023.2197135

Maimaiti, G., Jia, C, & Hew, K. F. (2021). Student disengagement in web-based videoconferencing supported online learning : an activity theory perspective. *Interactive Learning Environments, 0(0),* 1-20. https://doi.org/10.1080/10494820.2021.1984949

Makwana, D., Engineer, P., Dabhi, A., & Chudasama, H. (2023). *Sampling Methods in Research : A Review. June.*

Mao, S., Guo, L., Li, P., Shen, K., Jiang, M., & Liu, Y. (2023). New era of medical education: asynchronous and synchronous online teaching during and after COVID-19. *Advances in Physiology Education, 47(2),* 272-281. https://doi.org/10.1152/ADVAN.00144.2021

Mardiatmoko, G. (2024). *The Application of the Classical Assumption Test in Multiple Linear Regression Analysis (a Case Study of the Preparation of the Allometric Equations of Young Makila).* 5(3), 724-739.

Martin, F., & Carolina, N. (2022). *A Meta-Analysis on the Community of Inquiry Presences and Learning Outcomes in Online and Blended Learning Environments. 26(\),* 325-359. https://doi.org/10.24059/olj.v26il.2604

Mcroberts, R. E., & Blujdea, V. N. B. (2022). *Accommodating heteroscedasticity in allometric biomass models.* 1-37.

Md Sabri, S., Ismail, I., Annuar, N., Abdul Rahman, N. R., Abd Hamid, N. Z., & Abd Mutalib, H. (2024). a Conceptual Analysis of Technology Integration in Classroom Instruction Towards Enhancing Student Engagement and Learning Outcomes. *InternationalJournal of Education, Psychology and Counseling, 9(55),* 750-769. https://doi.org/10.35631/ijepc.955051

Mohammad Hekmat, A., Roghmal, S., Naeem Yaqubi, M., & Mustafa Kamal, M. (2022). *Development of Student Engagement in Higher Education 147*

= = === = === = === = ==== Language in India www. languageinindia. 22(10), 147-161. www.languageinindia.com

Mou, T. Y. (2023). Online learning in the time of the COVTD-19 crisis: Implications for the self-regulated learning of university design students. *Active Learning in Higher Education, 24(2),* 185-205. https://doi.org/10.1177/14697874211051226

Munna, S. H., Hossain, R., & Saylo, K. R. C. (2024). *Digital Education Revolution : Evaluating LMS- based Learning and Traditional Approaches. 6(2),* 21-40.

Musick, G, Schelble, B. G, Mallick, R., & McNeese, N. J. (2023). Selective Sharing is Caring: Toward the Design of a Collaborative Tool to Facilitate Team Sharing. *Proceedings of the Annual Hawaii International Conference on System Sciences, 2023-Janua(February),* 428-437. https://doi.org/10.24251/HICSS.2023.053

Naibert, N., Vaughan, E. B., Brevick, K., & Barbera, J. (2022). Exploring Student Perceptions of Behavioral, Cognitive, and Emotional Engagement at the Activity Level in General Chemistry. *Journal of Chemical Education, 99(3),* 1358-1367. https://doi.org/10.1021/acs.jchemed.lc01051

Nasri, N. F., Mohd Habali, A. H., & Mat Adam, M. H. (2022). Google Docs: Students' Perceptions as Online Collaborative Tool in Learning Writing Skills. *InternationalJournal of Academic Research in Progressive Education and Development,* 77(3), 690-705. https://doi.org/10.6007/ijarped/vll-i3/14611

Ndibalema, P. (2022). *Constraints of transition to online distance learning in Higher Education Institutions during COVID-19 in developing countries: A systematic review. 19(6),* 595-618. https://doi.org/10.1177/20427530221107510

Nkomo, L. M., Daniel, B. K., & Butson, R. J. (2021a). Synthesis of student engagement with digital technologies: a systematic review of the literature. *InternationalJournal of Educational Technology in Higher Education, 18(1),* 34. https://doi.org/10.1186/s41239-021-00270-l

Nkomo, L. M., Daniel, B. K., & Butson, R. J. (2021b). Synthesis of student engagement with digital technologies: a systematic review of the literature. *International Journal of Educational Technology in Higher Education, 18(1),* 1-26. https://doi.org/10.1186/s41239-021-00270-l

Ok, E., Grace, J., & John, M. (2024). *Collaborative Learning Tools. November.*

Oliveira, E., Caldini, C, Avaliacao, C. C.-A. R. da, & 2023, U. (2023). Definition of student engagement in higher education: a bibliometric study. *SciELO Brasil.* https://www.scielo.br/j/aval/a/yZW5JkvzQfpwdVZTW6MmyPs/?lang=en

Onyutha, C. (2022). *A hydrological model skill score and revisedR-squared.* 53(1), 51-64. https://doi.org/10.2166/nh.2021.071

Osman, A. R., Raihan Joarder, M. H., Hoque, K., & Jakowan. (2024). Student engagement, brand image and loyalty relationships: The mediating role of student satisfaction. *Journal of Education andE-Learning Research,* 77(2), 311-

321. https://doi.org/10.20448/jeelr.vlli2.5553

Oyarzun, B. (2023). *A Systematic Review of Research on Online Learner Collaboration from 2012 - 21: Collaboration Technologies, Design, Facilitation, and Outcomes.* 27(1), 71-106. https://doi.org/10.24059/olj.v27il.3407

OZBEK, O. (2025). *Educational Technologies Concept and Web 2 . 0 Tools: A Case Study with Pre-Service Foreign Language Egi tim Teknolojileri Kavrami ve Web 2 . 0 Araqlari: Yabanci Dil Ogretmen Adaylanyla Gergeklestirilmis Bir Durum Cahsmasi.* ¥5(1), 279-314.

Pai, G., & Pai, G. (2025). Using Formative Assessment and Feedback from Student Response Systems (SRS) to Revise Statistics Instruction and Promote Student Growth for All Using Formative Assessment and Feedback from Student Response Systems (SRS) to Revise Statistics Instructio. *Journal of Statistics and Data Science Education,* 0(0), 1-16. https://doi.org/10.1080/26939169.2024.2321241

Pai, I. N., Budi, D. A. N., Subject, P., Smpn, A. T., & Banyuwangi, G (2023). ICHES : International Conference on Humanity Education and Social. *International Conference on Humanity Education and Sosial,* 2(1), 11.

Pandya, B., & Patterson, L. (2021). *Pedagogical transitions experienced by higher education faculty members - " Pre-Covid to Covid. " June.* https://doi.org/10.1108/JARHE-01-2021-0028

Pinho, M., & Gomes, S. (2024). Generation Z as a critical question mark for sustainable tourism - An exploratory study in Portugal. *Journal of Tourism Futures,* 70(3), 486-503. https://doi.org/10.1108/JTF-07-2022-0171

Prasetya, R. E. (2023). The flipped english language learning through microsoft team application: analytical post covid-19 pandemic critical study. *English Teaching Journal: A Journal of English Literature, Language and Education, 11(1),* 55-64. https://doi.org/10.25273/etj.vllil.13562

Qassrawi, R. M., Mahmoud, S., & Karasneh, A. (2023). Benefits of Facebook Usage (as a Web 2 . 0 Application) in Foreign Language Instruction in Higher Education : A Meta-Analysis Study Benefits of Facebook Usage (as a Web 2 . 0 Application) in Foreign Language Instruction in Higher Education : A Meta-An. *Cogent Arts & Humanities, 10(1),* 0-12. https://doi.org/10.1080/23311983.2023.2185447

Qureshi, M. A., Qureshi, J. A., & Yousufi, S. Q. (2021). Factors affecting students ' learning performance through collaborative learning and engagement. *Interactive Learning Environments,* 0(0), 1-21. https://doi.org/10.1080/10494820.2021.1884886

Rafika RakhmahD, M. D. N., & Jha, G. K. (2024). *Beyond the Classroom: A Comprehensive Analysis of Teacher Personality Competence, Parenting Styles, and Their Joint Influence on the Character Formation in Junior High School Education 156 Indonesian Journal on Learning and Advanced Education.* 6(2020), 156-169. https://doi.org/10.23917/ijolae.v6i2.23142

Rahman, M. M., Tabash, M. I., Salamzadeh, A., Abduli, S., & Rahaman, M. S. (2022). Sampling Techniques (Probability) for Quantitative Social Science Researchers. *SEEUReview,* 77(1), 42-51.

Rahmatalla, F., Harun, J., & Abuhassna, H. (2024). *Exploring the Impact of the Community of Inquiry (Col) Framework on Student Engagement in Online Courses. 14(11),* 872-895. https://doi.org/10.6007/IJARBSS/vl4-ill/23597

Raj, H. D., & Singh, M. S. X. P. (2023). Gamified Student Response Systems for ESL Classrooms: An Analysis. *Journal of English Language Teaching, 65(6),* 25-37'.

Ramzan, M. (2023). *Perception of Students about Collaborative Strategies Employed by Teachers for Enhancing English Vocabulary and Learning Motivation. 2,* 146-158.

Rathna Sekhar, P., & Goud, S. (2024). Collaborative Learning Techniques in Python Programming: A Case Study with CSE Students at Anurag University. *Journal of Engineering Education Transformations,* 35(Special Issue 1), 243-249. https://doi.org/10.16920/jeet/2024/v38isl/24238

Reji, M., & Kumar, R. (2023). *Response surface methodology (RSM): An overview to analyze multivariate data.* 9(4), 241-247.

Rezeki, S., Rinaldi, M., Gustina, I., & Antonio Lodian. (2022). *JurnalManajemen Bisnis Eka Prasetya The Influence Of Consumer Behavior and Prices On Consumer Decisions to Buy Products At PT. Daikin Air conditioning Indonesia Jurnal Manajemen Bisnis Eka Prasetya.* 5(1), 284-294.

Rianita, E. (2022). *LEVERAGING GAMIFICATIONINTO EFL GRAMMAR CLASS TO. 22(2),* 90-114.

Richards, S. (2023). *Faculty Perception of Student Engagement in Online Anatomy Laboratory Courses During the COVID-19 Pandemic.pdf*

Rintaningrum, R. (2023). Technology integration in English language teaching and learning: Benefits and challenges. *Cogent Education, 10(1).* https://doi.org/10.1080/2331186X.2022.2164690

Robillos, R. J. (2023). Improving Students' Speaking Performance and Communication Engagement through Technology-Mediated Pedagogical Approach. *International Journal of Instruction, 16(1),* 551-572. https://doi.org/10.29333/iji.2023.16131a

Roman, T. A., Brantley-Dias, L., Dias, M., & Edwards, B. (2022). Addressing student engagement during COVTD-19: Secondary STEM teachers attend to the affective dimension of learner needs. *Journal of Research on Technology in Education, 54(S\),* S65-S93. https://doi.org/10.1080/15391523.2021.1920519

Rosenberg-Kima, A. S. & R. B. (2024). F2F, zoom, or asynchronous learning? Higher education students' preferences and perceived benefits and pitfalls. *International Journal of Science Education,* 1-26. https://doi.org/10.1080/09500693.2024.2355673

Rovetta, A., & Mansournia, M. A. (2024). *P > 0 . 05 Is Good: The NORD-h Protocol for Several Hypothesis Analysis Based on Known Risks, Costs, and Benefits Compatibility Intervals Instead of Confidence.* /(respectively 0), 511-520.

Salhab, R., & Daher, W. (2023). University Students' Engagement in Mobile Learning. *European Journal of Investigation in Health, Psychology and Education,* 73(1), 202-216. https://doi.org/10.3390/ejihpel3010016

Sandell, M. (2023). *http://www.diva-portal.org This is the published version of a paper presented at.* 519-526.

Sarah, C. (2025). *The intricacies of Student Engagement in Higher Education after the pandemic : Academic and Central Services staff views and experiences. 6(1),* 111-147.

Schiller, R., Fleckenstein, J., Mertens, U., Horbach, A., & Meyer, J. (2024). Computers & Education Understanding the effectiveness of automated feedback : Using process data to uncover the role of behavioral engagement -*k. Computers & Education,* 223(February), 105163. https://doi.Org/10.1016/j.compedu.2024.105163

Sengupta, S., & Vaish, A. (2023). *A study on social media and higher education during the COVID-19 pandemic.pdf.*

Shakki, F., & Pikhart, M. (2023). *What I know , what I want to know , what I learned:*

Activating EFL college students ' cognitive , behavioral, and emotional engagement through structured feedback in an online environment.

Shehzad, N., & Charles, T. (2023). Exploring the impact of instructor social presence on student engagement in online higher education. *Contemporary Educational Technology*, 75(4). https://doi.org/10.30935/cedtech/13823

Sifundza, S. L., & Utete, R. (2023). Adoption level of online learning by students: Evidence from an emerging academic institution in South Africa. *Journal of Pedagogical Sociology and Psychology*, 5(4). https://doi.org/10.33902/jpsp.202322407

Siregar, A., Wahyuni, R., & Taini, Z. (2023). *Students' Perception towards Synchronous and Asynchronous Learning Modes at Faculty of Teacher Training and Education.* XT(April), 15-24.

Sreedevi, S. (2022). *STUDY OF TEST FOR SIGNIFICANCE OF PEARSON'S CORRELATION COEFFICIENT. 816(2)*, 86-89.

Sun, W. (2024). *INVESTIGATING SOCIAL PRESENCE DYNAMICS IN ONLINE EDUCATION*.

Tabassum, Z. A., Rashid, M., & Mohd, B. (2024). *Community of Inquiry as an Instructional Framework: How Teaching, Social and Cognitive Presences Impact EFL Speaking in a Blended Setting in Bangladesh. 10,* 43-58.

Temizhan, E., Mirtagioglu, H., & Mendes, M. (2021). *Which Correlation Coefficient Should Be Used for Investigating Relations Which Correlation Coefficient Should Be Used for Investigating Relations between Quantitative Variables ? December.*

Thomas, J., & Nair, M. (2023). Investigating teacher influence on student engagement in high schools. *Australian Educational Researcher, 50(3),* 661-681. https://doi.org/10.1007/sl3384-022-00511-w

Timotheou, S., Miliou, O., Dimitriadis, Y., Sobrino, S. V., Giannoutsou, N., Cachia, R., Mones, A. M., & Ioannou, A. (2023). Impacts of digital technologies on education and factors influencing schools' digital capacity and transformation: A literature review. In *Education and Information Technologies* (Vol. 28, Issue 6). Springer US. https://doi.org/10.1007/sl0639-022-11431-8

Trowler, V., Allan, R. L., Bryk, J., & Din, R. R. (2021). Pathways to student engagement: beyond triggers and mechanisms at the engagement interface. *Higher Education,* 761-777. https://doi.org/10.1007/sl0734-021-00798-l

Tu, Y., Wang, Q., & Huang, C. (2025). *Facilitating Students ' Emotional Engagement in Synchronous Online Learning: A Systematic Literature Review. 26(1).*

Usman, M., I, I. N., Utaya, S., & Kuswandi, D. (2022). The Influence of JIGSAW Learning Model and Discovery Learning on Learning Discipline and Learning Outcomes. *Pegem Egitim ve Ogretim Dergisi, 12(2),* 166-178. https://doi.org/10.47750/pegegog.12.02.17

van der Meer, N., van der Werf, V., Brinkman, W. P., & Specht, M. (2023). Virtual reality and collaborative learning: a systematic literature review. *Frontiers in Virtual Reality, 4(May),* 1-16. https://doi.org/10.3389/frvir.2023.1159905

Varkey, T. C, Varkey, J. A., Ding, J. B., Varkey, P. K., Zeitler, C, Nguyen, A. M., Merhavy, Z. I., & Thomas, C. R. (2023). Asynchronous learning: a general review of best practices for the 21st century. *Journal of Research in Innovative Teaching and Learning*, 7(5(1), 4-16. https://doi.org/10.1108/JRIT-06-2022-0036

Vimbi, M. (2024). *EXAMINING THE ADVANTAGES OF STUDYING INE-LEARNING.* 77(1), 206-214.

Wagino, W., Maksum, H., Purwanto, W., Krismadinata, K., Suhendar, S., & Koto, R. D. (2023). Exploring the Full Potential of Collaborative Learning and E-Learning Environments in Universities: A Systematic Review. *TEM Journal,* 72(3), 1772-1785. https://doi.org/10.18421/TEM123-60

Wang, Q. (2024). Re-discover student engagement from the perspective of definition and influencing factors. *Frontiers in Psychology,* 75(January), 1-11. https://doi.org/10.3389/fpsyg.2024.1428668

Widowati, A., Siswanto, I., & Wakid, M. (2023). Factors Affecting Students' Academic Performance: Self Efficacy, Digital Literacy, and Academic Engagement Effects. *International Journal of Instruction, 16(4),* 885-898. https://doi.org/10.29333/iji.2023.16449a

Wong, Z. Y., & Liem, G. A. D. (2022). Student Engagement: Current State of the Construct, Conceptual Refinement, and Future Research Directions. In *Educational Psychology Review* (Vol. 34, Issue 1). https://doi.org/10.1007/sl0648-021-09628-3

Xu, Q. I., Wei, Y., Gao, J. I. E., & Yao, H. (2023). *ICAPD Framework and simAM-YOLOv8nfor Student Cognitive Engagement Detection in Classroom.* 77(December), 136063-136076. https://doi.org/10.1109/ACCESS.2023.3337435

Xu, X., Shi, Z., Bos, N. A., & Wu, H. (2023). Student engagement and learning

outcomes: an empirical study applying a four-dimensional framework. *Medical Education Online, 28(1).* https://doi.org/10.1080/10872981.2023.2268347

Yaguchi, R., & Ono, Y. (2024). *The Effect of Classroom Interventions of Reflection and Foreseeing on Mitigating Passive Procrastination in aHy- brid Learning Environment. 005.*

Zavodna, M., Havlaskova, T., Javorcik, T., & Kostolanyova, K. (2023). *Teacher Students' Perceptions of the Advantages and Disadvantages of Online andFace-To-Face Learning as a Basis for Designing Hybrid Learning.* 153-163. https://doi.org/10.34916/el.2023.15.13

Zen, Z., Reflianto, Syamsuar, & Ariani, F. (2022). Academic achievement: the effect of project-based online learning method and student engagement. *Heliyon,* 5(11). https://doi.Org/10.1016/j.heliyon.2022.ell509

Zhang, R., Bi, N. C, & Mercado, T. (2023). Do zoom meetings really help? A comparative analysis of synchronous and asynchronous online learning during Covid-19 pandemic. *Journal of Computer Assisted Learning, 39(1),* 210-217. https://doi.Org/10.l 111/jcal. 12740

Zhong, Q., Wang, Y., Lv, W., Xu, J., & Zhang, Y. (2022). Self-Regulation, Teaching Presence, and Social Presence: Predictors of Students' Learning Engagement and Persistence in Blended Synchronous Learning. *Sustainability (Switzerland), 14(9).* https://doi.org/10.3390/sul4095619

Zimba, O. (2023). *Designing, Conducting, and Reporting Survey Studies: A Primer for Researchers.* 35(48), 1-11.

APPENDICES

APPENDIX 1

QUESTIONNAIRES

Respondents: Lower secondary students (form 1-3)

VERSI BAHASA MELAYU

PENDAHULUAN

Sebagai sebahagian dari kajian tesis saya di Universiti Teknologi MARA (UiTM), saya menjalankan satu kajian untuk mengenalpasti minat pelajar dalam kelas secara online di kalangan murid sekolah menengah. Saya sangat menghargai sekiranya anda dapat menjawab kajian ini. Kajian ini mengambil masa hanya 10 minit. Jawapan anda akan dijaga dengan penuh kerahsiaan dan tidak akan mendedahkan maklumat anda. Sekiranya anda mempunyai sebarang pertanyaan berkenaan soalan ini, boleh hubungi Cik Sofea di 014 8211 809 atau di email 2021731485@student.uitm.edu.my **(Nota: Semua soalan wajib dijawab)**

BAHAGIAN A: DEMOGRAFIK

1. Berapakah umur kamu?

   Jawapan:_____

2. Apakah j antina kamu?

   Jawapan: CH PerempuanO Lelaki

3. Adakah kamu pernah belajar secara 'online'?

   Jawapan: • Ya • Tidak

BAHAGIAN B: PENGLIBATAN PELAJAR *(STUDENTENGAGEMENT)*

Sila nyatakan tahap kesetujuan anda dengan kenyataan di bawah. Sila pilih salah satu yang sesuai dengan jawapan anda untuk setiap soalan.

1 — Sangat Tidak Setuju
2 — Tidak Setuju
3 — Neutral
4 — Setuju
5 — Sangat Setuju

Teknologi Kolaboratif						
Perpaduan Komuniti (*Community Cohesion*)		1	2	3	4	5
CC1	Saya boleh mewujudkan suasana kolaboratif dan Kerjasama dengan kawan sekelas secara online.					
CC2	Saya menyapa kawan sekelas dalam kelas online					
CC3	Kawan sekelas menyapa saya dalam kelas online					
CC4	Saya dapat rasa kehadiran kawan sekelas di dalam kelas online.					
CC5	Saya rasa hubungan antara saya dan kawan sekelas dalam kelas online adalah sama seperti dalam kelas biasa					
CC6	Saya memanggil kawan saya dengan nama samaran mereka					
CC7	Kawan saya memanggil saya dengan nama samaran					
CC8	Saya merasakan saya terlibat semasa perbincangan berkumpulan dalam pembelajaran					
CC9	Saya rasa sesi perbincangan online sangat berkesan					
CC10	Saya merasakan rapat dengan rakan sekelas semasa perbincangan					
Pengetahuan dan Pengalaman (*Knowledge and Experienc e*)		1	2	3	4	5
KE1	Cikgu saya berkongsi pengalaman yang berguna dan berkaitan dalam kelas online.					
KE2	Cikgu saya sangat berpengetahuan dalam mata pelajaran yang diajar					
KE3	Cikgu saya mempunyai pengalaman dalam menggunakan teknologi					
KE4	Cikgu saya mempunyai kepakaran dalam bidang mengajar.					
KE5	Cikgu saya mempunyai pengalaman mengajar secara online.					

KE6	Cikgu saya membantu saya dalam menggunakan aplikasi untuk perbincangan online					
KE7	Cikgu saya menggunakan aplikasi yang sesuai untuk mengajar.					
KE8	Saya sangat berpuas hati dengan proses pembelajaran dalam kelas online.					
KE9	Saya sangat berpuas hati dengan hasil pembelajaran dalam kelas online.					
KE10	Saya akan syorkan kepada kawan untuk sertai kelas online.					

Kehadiran Sosial (*Social Presence*)						
Hubungan Emosi (*Affective Association*)		1	2	3	4	5
AA1	Saya mempunyai pelbagai tanggapan terhadap kawan-kawan sekelas ketika kelas online.					
AA2	Saya menonjolkan diri saya dalam kelas online.					
AA3	Saya menunjukkan emosi dalam kelas online					
AA4	Saya berkongsi maklumat peribadi dengan kawan sekelas					
AA5	Kawan-kawan saya berkongsi maklumat peribadi mereka dengan kawan sekelas					
AA7	Kawan sekelas membuatkan saya rasa lebih mesra semasa kelas online.					
AA8	Saya boleh mendapatkna sokongan emosi dari kawan sekelas ketika kelas online.					
AA9	Saya bekerjasama dengan kawan sekelas semasa kelas online.					
AAIO	Kelas online memberi motivasi kepada minat saya dalam pembelajaran berbanding kelas bersemuka.					
Kesungguhan Berinteraksi (*Interaction Intensity*)						
III	Saya menyatakan persetujuan dengan kawan sekelas tentang cadangan atau idea mereka.					

112	Saya memberikan pujian kepada idea dan cadangan kawan sekelas.					
ID	Saya rasa selesa ketika sesi perbicangan secara online					
114	Saya rasa selesa berinteraksi dengan rakan sekelas secara online.					
115	Saya mendapat maklum balas kepada soalan saya dalam kelas online.					
116	Saya boleh mendapat manfaat dari maklumat perbincangan di dalam kelas online.					
117	Kawan sekelas berkomunikasi dengan baik dan berkesan ketika menggunakan aplikasi belajar secara online					
118	Saya sentiasa berbincang tentang masalah dalam pembelajaran dengan kawan sekelas ketika kelas online					
119	Saya sentiasa berkongsi bahan pembelajaran dan idea dengan kawan sekelas ketika kelas online					
mo	Saya sentiasa berbincang tujuan pembelajaran dengan kawan sekelas ketika kelas online.					
Penglibatan Pengajar/Guru (*Instructor Involvement*)						
IIV1	Cikgu memberikan respon yang cepat terhadap soalan murid dalam kelas online.					
IIV2	Cikgu sentiasa ada apabila diperlukan oleh murid					
IIV3	Cikgu kerap menyertai dalam sesi perbincangan online.					
IIV4	Cikgu memberi sokongan dalam penglibatan murid semasa sesi perbincangan online.					
IIV5	Cikgu memberi maklum balas yang berkualiti tinggi					
IIV6	Cikgu sentiasa memberi maklum balas yang berguna.					

IIV7	Cikgu membantu untuk menambah baik penglibatan pelajar dalam kelas online					
IIV8	Cikgu sentiasa memulakan perbincangan secara online.					
IIV9	Komunikasi antara cikgu dan murid adalah baik					
IIV10	Saya rasa cikgu sangat membantu dengan soalan yang ditanya oleh murid.					

Penglibatan Pelajar *{Student's Engagement)*						
Tingkah Laku *(Behavioural)*		1	2	3	4	5
Bl	Semasa dalam kelas online, saya sertai aktiviti kelas					
B2	Semasa dalam kelas online, saya tidak fokus					
B3	Saya mencuba untuk berusaha bersungguh-sungguh dalam kelas online					
B4	Saya memberi perhatian dalam kelas online					
B5	Sekiranya saya ada masalah untuk faham, saya akan mengulangkaji sehingga saya faham.					
B6	Apabila saya ada masalah dengan kerja rumah, saya akan berusaha sehingga saya dapat selesaikannya.					
B7	Saya rasa bertanggungjawab dengan pembelajaran saya.					
B8	Saya banyak belajar tentang penggunaan komputer untuk menyampaikan maklumat.					
B9	Saya adalah murid yang aktif dalam kelas online.					
BIO	Saya rasa yakin menggunakan aplikasi computer.					
Kognitif *{Cognitive)*						
CI	Semasa belajar, saya berfikir bagaimana					

	maklumat itu boleh memberi manfaat kepada dunia luar.					
C2	Semasa belajar, saya cuba keluarkan idea dengan cara dan ayat saya tersendiri					
C3	Semasa belajar, saya cuba gabungkan maklumat berbeza dari bahan belajar, dan cari cara baru untuk faham.					
C4	Saya buat dan cari contoh tersendiri untuk bantu saya memahami konsep penting tentang apa yang saya belajar dalam kelas online.					
C5	Saya cuba mencari persamaan di antara benda yang saya belajar dan benda yang saya dah tahu.					
C6	Saya lebih suka untuk mendalami sesuatu topik yang dipelajari daripada hanya membaca topik dengan sepintas lalu					
C7	Saya rasa teruja untuk memberikan idea baru					
C8	Saya lebih yakin dengan kebolehan saya untuk terus belajar.					
Emosi (*Emotional*)						
E**l**	Saya rasa belajar dalam kelas online adalah menarik					
E2	Saya rasa belajar dalam kelas online adalah membosankan					
E3	Saya sangat berminat untuk belajar online					
E4	Saya rasa belajar bersemuka sangat menyeronokkan					
E5	Saya suka apa yang saya belajar dalam kelas online					
E6	Saya seronok dengan pembelajaran online					
E7	Saya bangga dapat belajar secara online					

E8	Saya teruja untuk belajar secara online dengan kawan sekelas					
E9	Saya rasa diterima dan disukai oleh rakan sekelas ketika perbincangan secara online					

ENGLISH VERSION

INTRODUCTION

As part of my MSc research thesis at the University of Technology MARA (UiTM), I am conducting a survey that investigates students' engagement during online learning session among secondary school students. I would appreciate if you could complete the following survey. It should only take 10 minutes. Your answer will be treated with complete confidentiality and it will be entirely anonymous. If you have any questions about this questionnaire, please contact Ms. Sofea at 014 8211 809 or email 2021731485@student.uitm.edu.my **(Nota: All questions need to be answered)**

PART A: DEMOGRAPHIC

1. How old are you?

   Answer:_____

2. What is your Gender?

   Answer: CH Female CH Male

3. Do you have experience in the online class?

   Answer: D Yes CH No

PART B: STUDENT ENGAGEMENT MODEL

Please indicate your level of agreement with the statements below. Please choose the one most
appropriate response to each question.

1 — Strongly Disagree
2 — Disagree
3 — Neutral
4 — Agree
5 — Strongly Agree

Collaborative Technology						
Community Cohesion		1	2	3	4	5
CC1	I can develop a sense of collaboration with my friend.					
CC2	I greet my friend in online class					

CC3	My friend greets me in online class					
CC4	I can feel the presence of my friends in online class					
CC5	I feel that the relationship between me and my friend in online class is the same as in real classroom					
CC6	I called my friend by their nickname					
CC7	My friend called me with my nickname					
CC8	I used 'we' to discuss with my friend in online group discussions					
CC9	I feel I am part of a learning group					
CC10	The online group discussion was effective and makes me feel united.					
Knowledge and Experience		1	2	3	4	5
KE1	My teacher shared his/her relevant experience with online class					
KE2	My teacher seemed to have a lot of knowledge in the field they teach					
KE3	The teacher seemed to have experiences with technology					
KE4	The teacher seemed to have the expertise to do his/her job.					
KE5	The teacher had online teaching experience.					
KE6	My teacher helps me in using online discussion applications					
KE7	My teacher used suitable application for teaching					
KE8	I'm very satisfied with the learning process of online class					
KE9	I'm very satisfied with the learning outcomes of online class					
KE10	I will recommend to my friends to participate in online class					

Social Presence						
Affective Association		1	2	3	4	5
AA1	I have different impressions towards my friends in class					
AA2	I projected who I am to other course participants.					
AA3	I expressed emotions in the online class					
AA4	I share personal information about life outside of online class.					
AA5	My friends share personal information in the online class.					
AA6	My friends make me feel very friendly while participating in online class					
AA7	I can get emotional support from my friends while participating in online courses					
AA8	I work together with my friends while participating in online class.					
AA9	Online class can better motivate my interest in learning than traditional classroom					
Interaction Intensity						
III	I expressed agreement or disagreement with my friends or the content of my friend's ideas.					
112	I complimented others or the content of my friend's ideas.					
ID	I felt comfortable participating in online discussions.					
114	I felt comfortable interacting with my friends.					
115	I received answers to the questions I asked.					
116	I can easily obtain the detailed information that I want while participating in online class.					
117	My friends communicated effectively using online communication tools (e.g. email, and instant messaging).					

118	I always discuss learning problems with my friends while participating in online class					
119	I always share learning materials and ideas with my friends while participating in online class.					
mo	I always discuss learning objectives with my friends while participating in online class.					
Instructor Involvement						
IIV1	The teacher give fast respond to students' questions					
IIV2	The teacher was always available.					
IIV3	The teacher participated in the online discussions frequently.					
IIV4	The teacher support student engagement in the online discussions.					
IIV5	The teacher provided high quality feedback					
IIV6	The teacher always provided useful feedback.					
IIV7	The teacher helps to improve student engagement in the online discussions.					
IIV8	The teacher always start the online discussions					
IIV9	The communication between teacher and students is good					
IIV10	I find the teacher helpful when asked questions					

Student's Engagement						
Behavioural		1	2	3	4	5
Bl	When I'm in class, I participate in class activities.					
B2	When I'm in class, I'm not focus.					
B3	I try hard to do well in the class.					
B4	I pay attention in the class.					
B5	If I have trouble understanding, I go over it again until I understand it.					
B6	When I run into a difficult homework					

	problem, I keep working at it until I think I've solved it.					
B7	I feel I can take the responsibility of my own learning					
B8	I have learned more about using computers for presenting information.					
B9	I am an active participant in the school activities.					
BIO	I feel confident in using computer applications when needed.					
Cognitive						
CI	When I study, I figure out how the information might be useful in the real world.					
C2	When I learning, I try to put the ideas in my own words.					
C3	When studying, I try to combine different information from learning material in new ways.					
C4	I create and find my own examples to help me understand the important concepts I learn in classes.					
C5	I try to see the similarities and between things I am learning in classes and things I know already					
C6	I try to think through the topics and decide what I'm supposed to learn from them, rather than studying topics by just reading them over.					
C7	I have been challenged to come up with new ideas					
C8	I have become more confident of my ability to continue study.					

Emotional						
E1	I think what we are learning in school is interesting					
E2	I think learning is boring					
E3	I am very interested in learning.					
E4	I think learning in school is interesting.					
E5	I like what I am learning in school.					
E6	I enjoy my class.					
E7	I am proud to be in the class.					
E8	Every morning, I cannot wait to going to the class.					
E9	I feel accepted in my class group discussions.					

APPENDIX 2

Research Ethic Approval

UNIVERSITI TEKNOLOGI MARA

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Reference : 6CO-TNCPl (5J1JEJ
Our reference : F E C I 1.7022 •\PG.'WrUZW:
Cm : 29 Novenner 2022

Dr hldorlhan t-lntl Abdul Rahman R Abdul Hathld
(Nur Zruitf tofta binll Khalrul Anuar -2di1TJ14flS)
Cdkroe of CompLtlng.. rrtormadci and Media
umu Ketarton Branch
Kdta Bharu Campus.. LembahSlreh
•=CEC- Kdta E-harj
Kelantan

Dear Dr Noorinan,

APPROVAL LETTER - UrTM HE4EARCH ETHICS COMMITTEE

Thank, ^ou Ibr HJbmtUng >iour research proposal to the =!>esejrch Ethics Cnmmltnee i;RBC.i. *A*xr* consttertia your application, the Cocimttee apposed >CLr orooosa :teo "EtLder: Eijagerer: Model ^or Co laboralIve Techndlogics, n O-nlne Le-amlng" at secondary schcos In Kelantan ;Gua M Jiang, Kiotai Bharu. Macrdna, Jel, Tanah Merah.Bacho* andPasrFuteh;.

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H JITM: r: td urtairel:	1 Dr Nocr "isr b *ri* AtdJ fi ahman <*1£* Aodul RashU 2 NLr Z.-iar' Ejtea thll K.-aru Arua' J Dr Z-rar c nd Ahmad 2uka'nan 4. Assoc. Pro[1]. Dr rt'an Aolal- bnt Wan Adrian

The UITM Research Edits Committee operates In acccrdar ce to the ICH Good Clinical Prance Guldelnes, Mabyslan Good Clnkca Pracllce Guidelines and the Declaration o[J] Hcls-hrtl. The accos'al of this project Is condlbonal upon your conbnukig complbnce »1t- these guide nes and :<c *i-a:* :r

We ora* tc ysLr atlendjn Ihe requrerrer:Tial a "epytor Tis "esearx-i, mus: oe s.-fcmHed every 12 months- hum the date o[1] trr approsa cf sn die co D e:cn cr toe pojec: wh cheve' occu"s flrsl. Falure to subnrt reports All resuh r wt~rf"a«va c[J] CDnsenl 1tar the project co proceed. Amcndrwrrl::, h any, -ta me study document arc- 1a be submrrted to the REG *Y* apprcval

If yau requre forther Information, pease contact Hie REC Setretmat at D3-^=4-^SC€E0i-EE4427Si Df email at rccsecrctarabgutm.edu.my.

Yours sincerely.

EMERfTUE PRDFE**DRA>ATO' DR RAYMOND KZMHN ALI
Gasman
UITH Rescarc-i ETICS Sarrrr flee

c.c: Rector, UITM Kelantan Branch

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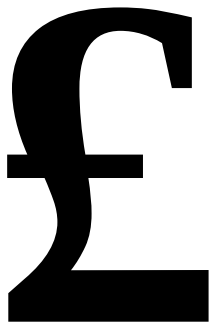
AUTHOR'S PROFILE



Nur Zharif Sofea Khairul Anuar obtained Bachelor of Information Technology (Hons.) Business Computing in 2022 from Universiti Teknologi MARA, Kampus Kuala Terengganu. Recently has completed her Master of Science (Information Technology) in 2026.from Universiti Teknologi MARA, Kampus Kota Bharu. Her research interests include statistical analysis, data modelling, and quantitative research methods. Her master's thesis focuses on examining the relationship between multiple variables namely Collaborative Technology, Social Presence Theory, and Student Engagement using multiple linear regression analysis to understand factors influencing the studied outcome.

LIST OF PUBLICATION:

Anuar, N. Z. S. K, Abdul Rahman, N., Zukarnain, Z. A., & Nordin, N. I. (2025). Reliability Analysis of Student Engagement Model in Using Collaborative Technology. Journal of Information System and Technology Management, 10(40), 243-255. https://doi.org/10.35631/JISTM.1040017

Khairul Anuar, N. Z. S., Abdul Rahman, N., Ahmad Zukarnain, Z., & Nordin, N. I. (2025). Reconstruction of student engagement model for collaborative technology. Journal of Islamic, Social, Economics and Development, 10(78), 1-14. Retrieved from https://academicinspired.com/jised/article/view/3620