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UNIMAS

Faculty of Computer Science and Information Technology

Adoption of Blended Learning in Computer Science Education: A Study Using the IS Success Model

KIRTHANA KANNAN

Bachelor of Computer Science with Honors

(Information Systems)

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KIRTHANA KANNAN

The project is submitted in partial fulfilment of the

Requirements for the degree of

Bachelor of Computer Science with Honors

(Information Systems)

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2025

DECLARATIONS

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Kirthana

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Lastly, to all the participants who took time to respond to my survey: thank you. Your willingness to contribute made this research possible, and I truly appreciate your input.

This project reflects not just my work, but the kindness, effort, and support of many people. Thank you all from the bottom of my heart.

ABSTRACT

This study investigates the adoption of blended learning in computer science education at Universiti Malaysia Sarawak (UNIMAS), focusing on how Learning Management System (LMS) quality influences student satisfaction, engagement, and academic performance. Guided by the Technology Acceptance Model (TAM) and the Information Systems Success Model (IS Success Model), the research examines how System Quality, Information Quality, and Service Quality influence Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), and how these perceptions affect students' academic performance.

A quantitative survey design was employed, using a structured questionnaire administered to 191 undergraduate computer science students. Data were analyzed in SPSS using descriptive statistics, reliability testing, correlation, multiple regression analysis, and diagnostic checks. The findings revealed that System Quality and Information Quality significantly predicted both PU and PEOU, while Service Quality showed no significant direct effect. PU significantly influenced Satisfaction and Engagement, which in turn were strong predictors of Academic Performance. However, PEOU did not directly influence Satisfaction or Engagement. Overall, six out of nine hypotheses were supported. Qualitative insights from open-ended survey responses further contextualized students' challenges and suggestions for improving LMS effectiveness.

The study validates a refined Blended Learning Adoption Model tailored for technical education and highlights the central role of perceived usefulness, content quality, and student engagement in supporting academic success. Practical implications are offered for LMS designers, educators, and academic institutions seeking to improve blended learning effectiveness.

ABSTRAK

Penyelidikan ini meneliti penggunaan pembelajaran teradun dalam pendidikan sains komputer di Universiti Malaysia Sarawak (UNIMAS), dengan memberi tumpuan kepada bagaimana kualiti Sistem Pengurusan Pembelajaran (LMS) mempengaruhi kepuasan pelajar, penglibatan, dan prestasi akademik. Berpandukan Model Penerimaan Teknologi (TAM) dan Model Kejayaan Sistem Maklumat (ISSM), kajian ini menilai bagaimana Kualiti Sistem, Kualiti Maklumat, dan Kualiti Perkhidmatan mempengaruhi Persepsi Kegunaan (PU) dan Persepsi Kemudahan Penggunaan (PEOU), serta bagaimana persepsi ini mempengaruhi prestasi akademik pelajar.

Pendekatan kuantitatif digunakan melalui soal selidik berstruktur, dan data daripada 191 responden dianalisis menggunakan statistik deskriptif, ujian kebolehpercayaan, analisis korelasi, analisis regresi berganda, dan diagnostik regresi melalui perisian SPSS. Dapatan kajian menunjukkan bahawa Kualiti Sistem dan Kualiti Maklumat mempunyai pengaruh yang signifikan terhadap PU dan PEOU, manakala Kualiti Perkhidmatan tidak menunjukkan kesan langsung yang signifikan. PU memberi kesan signifikan terhadap Kepuasan dan Penglibatan, yang seterusnya menjadi peramal kukuh bagi Prestasi Akademik. Walau bagaimanapun, PEOU tidak memberi kesan langsung terhadap Kepuasan atau Penglibatan. Secara keseluruhan, enam daripada sembilan hipotesis telah disokong. Dapatan kualitatif daripada soalan terbuka dalam tinjauan turut memberikan konteks tambahan terhadap cabaran yang dihadapi serta cadangan penambahbaikan.

Dapatan kajian ini mengesahkan Model Penerimaan Pembelajaran Teradun yang telah diperhalusi, khusus untuk konteks pendidikan teknikal, dan menekankan peranan utama persepsi kegunaan, kualiti kandungan, dan penglibatan pelajar dalam menyokong kejayaan akademik. Implikasi praktikal turut dikemukakan untuk pembangun LMS, pendidik, dan institusi akademik yang ingin meningkatkan keberkesanan pembelajaran teradun.

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CHAPTER 1: INTRODUCTION

1.1 Background

Blended learning, an educational model combining face-to-face instruction with online components, has become increasingly common in higher education due to its flexibility and ability to accommodate diverse learning preferences. By merging in-person and digital interactions, blended learning creates distinctive opportunities to enhance educational methods, offering students the accessibility of online resources with the engagement of traditional classroom experiences (Yu, Dai, & Wang, 2023). In computer science education, where both theoretical understanding and hands-on technical skills are vital, blended learning holds promise, as it meets varied student needs through online resources, interactive simulations, and collaborative tools (Anthony Jnr, 2024).

However, the successful implementation of blended learning depends on several essential key quality factors. Research by Anthony Jnr (2024) suggests that academic outcomes improve when blended learning environments emphasize system quality (reliability, accessibility, usability), information quality (clarity, relevance, accuracy), and service quality (availability and responsiveness of support). These factors collectively impact students' perceptions of the learning platform, which significantly influences their engagement and willingness to adopt blended learning. Laifa, Giglou, & Akhrouf (2023) found a strong correlation between student satisfaction in blended learning and the effectiveness of the platform in supporting self-paced and interactive learning, which enhances engagement.

Implementing blended learning in computer science presents distinct challenges. Technical education often requires access to specialized software, interactive coding environments, and resources that many standard LMS platforms do not fully support. This gap reveals a need for tailored blended learning strategies within technical fields to maximize learning effectiveness and outcomes (Bervell & Arkorful, 2020). Collaborative digital environments are particularly important in blended learning, as they foster engagement through forums, group projects, and interactive tools (Ansari & Khan, 2020). However, these requirements often highlight the limitations of existing LMS platforms, which frequently lack the robust support needed for the complexities of technical subjects.

Furthermore, studies indicate that students' perceptions of an LMS's ability to meet their learning needs directly impact the effectiveness of blended learning. Atukunda, Khabusi, & Othieno (2024) examined e-learning satisfaction and revealed that system reliability, information clarity, and the availability of support services are critical in shaping student experiences. Likewise, Bervell & Arkorful (2020) found that high-quality LMS information and support services significantly enhance student engagement, leading to better academic performance. Without these support structures, students in technical fields may struggle to fully utilize blended learning, potentially limiting their academic success.

In summary, while blended learning has substantial potential to enhance computer science education, addressing key challenges is essential for successful adoption. Further investigation is required to optimize LMS platforms for computer science, where system, information, and service quality play crucial roles. This study seeks to address these gaps by examining factors that influence blended learning adoption in computer science and exploring improvements in LMS features to support technical education, thereby enhancing student engagement and academic outcomes.

1.2 Problem Statement

Blended learning, which combines face-to-face and online instruction, has become integral to modern education, offering flexibility and adaptability. However, adopting blended learning in technical disciplines like computer science poses unique challenges due to the field's need for specialized resources such as programming tools and interactive coding environments (Anthony Jnr, 2024). Current LMS often lacks the tailored support required for these needs, limiting blended learning's effectiveness, and impacting student performance (Laifa, Giglou, & Akhrouf, 2023).

While blended learning has potential benefits, computer science students frequently encounter barriers in fully utilizing these environments. Common issues include low system quality, limited interactivity, and inadequate instructor support, all of which can negatively impact students' engagement and satisfaction (Ansari & Khan, 2020). Research shows that LMS platforms often fail to meet the interactive and hands-on demands of technical subjects, undercutting the advantages blended learning could bring in improving engagement and academic outcomes (Bervell & Arkorful, 2020).

To create effective blended learning environments, it is crucial to understand the factors influencing their adoption in technical education. Key factors influencing student engagement and acceptance in these platforms include system quality (usability and dependability), information quality (clarity and relevance), and service quality (support and response). When an LMS fails to meet expectations, both engagement and academic success are affected particularly in computer science, where practical learning components are critical.

This study aims to identify the factors influencing blended learning adoption among computer science students and assess their impact on engagement and academic outcomes. By doing so, it seeks to optimize blended learning for technical education, enhancing the overall academic experience for students in this field.

1.3 Scope

This study focuses on UNIMAS undergraduate computer science students' blended learning using an LMS. Computer science education benefits from blended learning because it integrates theoretical knowledge with practical skills, both crucial in technological fields where hands-on experience is essential. Due to technical learning special needs, the LMS supplements face-to-face teaching with online tools for brainstorming, collaboration, and course materials.

The research will include freshman to senior computer science students to collect varied opinions. This technique seeks to examine how blended learning attitudes change across academic progression. By conducting this research within UNIMAS, a single institution with a structured blended learning program, the study ensures a consistent educational environment. This arrangement offers controlled data collection aligned with students' blended learning experiences, focusing on LMS system, information, and service quality.

1.4 Objective

This study aims to evaluate the adoption of blended learning in computer science education through assessing key factors that influence student engagement, acceptance, and academic performance. This study integrates the Information Systems (IS) Success Model and the Technology Acceptance Model (TAM) to provide insights into how system quality, information quality, and service quality affect students' learning experiences in blended learning environments.

- To identify key factors influencing blended learning adoption in computer science education.
- To assess how system quality, information quality, and service quality within blended learning environments impact student acceptance and engagement.
- To analyze blended learning's effect on engagement and academic performance among computer science students.

1.5 Methodology

To achieve the study's objectives, this research will adopt a quantitative approach using established frameworks and statistical tools, focusing on the Information Systems (IS) Success Model and the Technology Acceptance Model (TAM). The following components outline the research model, target audience, data collection methods, and analysis techniques:

1.5.1 Research Model

This study will utilize two complementary theoretical frameworks: the IS Success Model and the TAM. These models are well-suited to evaluate the adoption of blended learning in computer science education.

- **Information Systems (IS) Success Model:** This model evaluates factors like system quality (how effectively and reliably the LMS functions), information quality (the clarity, relevance, and usability of the course content), and service quality (responsiveness and support provided to students). By focusing on these components, the IS Success Model can help identify the specific attributes that contribute to student satisfaction and engagement in blended learning environments.

- **Technology Acceptance Model (TAM):** TAM is widely used to assess how users come to accept and use technology, focusing on perceived usefulness (whether the system enhances learning outcomes) and perceived ease of use (how intuitive and accessible the system feels to students). TAM provides a structured way to measure how these perceptions impact students' willingness to adopt and engage with the blended learning approach.

1.5.2 Data Collection

Data collection will be conducted through a structured survey questionnaire designed based on the IS Success Model and TAM frameworks. Key components of the data collection process include:

- **Survey Design:** The survey will be organized into sections to capture information on system quality, information quality, service quality, perceived usefulness, and perceived ease of use. Each section will include Likert-scale questions to quantitatively measure students' perceptions and experiences with blended learning in their computer science courses.
- **Sampling Method:** A stratified sampling method will be used, ensuring that participants represent different years of study (e.g., freshman, sophomore, junior, and senior students) within the computer science program. This will allow for a more comprehensive understanding of how perceptions of blended learning may vary across different academic levels.
- **Survey Distribution:** The survey will be distributed online through social media or student group chats, encouraging participation from students actively involved in blended learning courses. The use of an online survey aligns with the nature of the research, as it allows students to complete it at their convenience, reflecting their blended learning experience.

1.5.3 Data Analysis

After data collection, the study will apply a range of statistical techniques to analyze the survey responses:

- **Descriptive Statistics:** SPSS will be used to summarize the data, providing an overview of students' overall perceptions of system quality, information quality, and service quality. This step will help identify general trends in how students experience and perceive the blended learning environment.
- **Reliability Testing:** Cronbach's Alpha will be used to assess the internal consistency and reliability of survey items. Validity checks will ensure that the survey accurately measures the constructs defined by the IS Success Model and TAM frameworks.
- **Regression Analysis:** Regression analysis will further examine how specific factors, such as system quality and service quality, independently influence student engagement and academic outcomes. This analysis will provide insights into which aspects of the blended learning system are most significant in predicting positive outcomes in computer science courses.
- **Correlation Analysis:** The relationship between variables will be explored by conducting correlation analysis. This will provide insights into the strength and the direction of these relationships.
- **Regression Diagnostics:** The analysis will include checks for model adequacy, using R-squared values and residual analysis to ensure the robustness of the regression models.

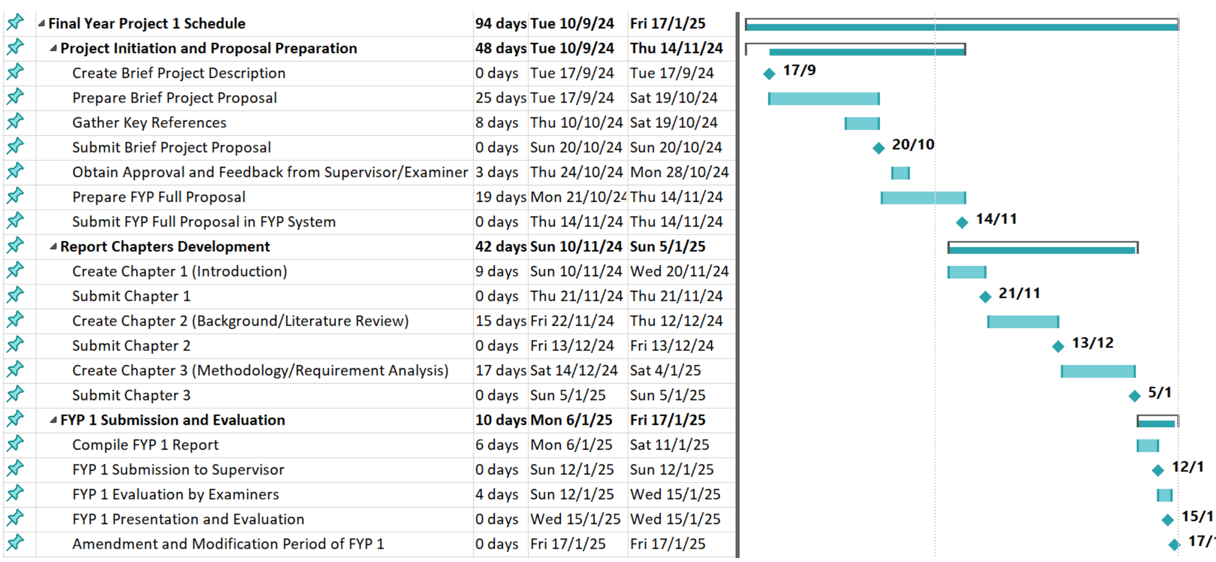
1.6 Significant of Project

This research is significant for advancing blended learning strategies within technical education, particularly in computer science. By focusing on computer science students at UNIMAS, this study addresses a critical gap in understanding how blended learning environments can be optimized for the unique demands of technical fields. Computer science students often require specialized resources, such as collaborative tools and technical learning support, that traditional LMS platforms may not fully accommodate.

By identifying key factors such as system quality, information quality, and service quality that influence the adoption of blended learning in computer science, this study provides valuable insights for improving LMS design and instructional strategies across technical disciplines. These findings can guide enhancements in LMS platforms to better support both engagement and learning outcomes for students in technical fields.

Additionally, this research contributes to the broader domain of educational technology by offering a framework for blended learning adoption that can be adapted by other institutions. The findings will be relevant for universities and technical programs seeking to enhance blended learning environments, providing actionable insights for curriculum developers, educators, and LMS designers to create more effective learning experiences. In doing so, this study supports the advancement of blended learning not only within UNIMAS but also for technical education more broadly.

1.7 Project Schedule



Final Year Project 1 Schedule	**94 days**	**Tue 10/9/24**	**Fri 17/1/25**
Project Initiation and Proposal Preparation	**48 days**	**Tue 10/9/24**	**Thu 14/11/24**
Create Brief Project Description	0 days	Tue 17/9/24	Tue 17/9/24
Prepare Brief Project Proposal	25 days	Tue 17/9/24	Sat 19/10/24
Gather Key References	8 days	Thu 10/10/24	Sat 19/10/24
Submit Brief Project Proposal	0 days	Sun 20/10/24	Sun 20/10/24
Obtain Approval and Feedback from Supervisor/Examiner	3 days	Thu 24/10/24	Mon 28/10/24
Prepare FYP Full Proposal	19 days	Mon 21/10/24	Thu 14/11/24
Submit FYP Full Proposal in FYP System	0 days	Thu 14/11/24	Thu 14/11/24
Report Chapters Development	**42 days**	**Sun 10/11/24**	**Sun 5/1/25**
Create Chapter 1 (Introduction)	9 days	Sun 10/11/24	Wed 20/11/24
Submit Chapter 1	0 days	Thu 21/11/24	Thu 21/11/24
Create Chapter 2 (Background/Literature Review)	15 days	Fri 22/11/24	Thu 12/12/24
Submit Chapter 2	0 days	Fri 13/12/24	Fri 13/12/24
Create Chapter 3 (Methodology/Requirement Analysis)	17 days	Sat 14/12/24	Sat 4/1/25
Submit Chapter 3	0 days	Sun 5/1/25	Sun 5/1/25
FYP 1 Submission and Evaluation	**10 days**	**Mon 6/1/25**	**Fri 17/1/25**
Compile FYP 1 Report	6 days	Mon 6/1/25	Sat 11/1/25
FYP 1 Submission to Supervisor	0 days	Sun 12/1/25	Sun 12/1/25
FYP 1 Evaluation by Examiners	4 days	Sun 12/1/25	Wed 15/1/25
FYP 1 Presentation and Evaluation	0 days	Wed 15/1/25	Wed 15/1/25
Amendment and Modification Period of FYP 1	0 days	Fri 17/1/25	Fri 17/1/25

Figure 1 FYP1 Project Schedule

Task Name	Duration	Start	Finish
Final Year Project 2 Schedule	**91 days?**	**Mon 24/3/25**	**Mon 28/7/25**
Revised Structure	**7 days?**	**Mon 24/3/25**	**Tue 1/4/25**
Revise FYP Report Structure	7 days	Mon 24/3/25	Tue 1/4/25
Submit Revised FYP Report	0 days	Tue 1/4/25	Tue 1/4/25
Report Progress Development	**50 days**	**Wed 2/4/25**	**Tue 10/6/25**
Create Chapter 4 (Result and Analysis)	9 days	Wed 2/4/25	Mon 14/4/25
Chapter 4 Draft Submission	0 days	Thu 15/5/25	Thu 15/5/25
Create Chapter 5 (Conclusion)	11 days	Fri 16/5/25	Fri 30/5/25
Final Chapter Draft Submission	0 days	Sat 31/5/25	Sat 31/5/25
FYP 2 Full Report Draft Submissio	0 days	Tue 10/6/25	Tue 10/6/25
FYP 2 Full Paper Draft Submission	0 days	Tue 10/6/25	Tue 10/6/25
FYP 2 Submission and Evaluation	**34 days**	**Wed 11/6/25**	**Mon 28/7/25**
Compile FYP 2 Final Report			
Final Year Project Symposium	0 days	Tue 1/7/25	Tue 1/7/25
FYP 2 Submission to Supervisor	2 days	Fri 20/6/25	Mon 23/6/25
FYP 2 Evaluation by Examiners	1 day	Mon 23/6/25	Mon 23/6/25
Amendment and Modification Period of FYP 1	14 days	Tue 1/7/25	Fri 18/7/25
Submission of Final Report	0 days	Mon 28/7/25	Mon 28/7/25

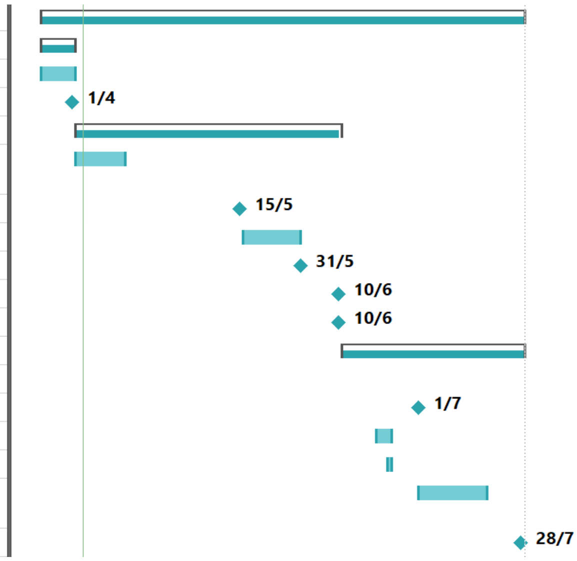


Figure 2 FYP2 Project Schedule

1.8 Project Outcome

1.8.1 Blended Learning Adoption Model for Computer Science

A primary outcome of this research will be the development of a Blended Learning Adoption Model tailored to the specific needs of computer science students. The IS Success Model and TAM frameworks will be used to examine system, information, and service quality to determine what drives effective blended learning engagement. For instance, the model could suggest institutions to prioritize certain LMS characteristics based on system quality, such as easy access to technical resources, if it is determined that this is a critical factor. This model will guide educators and institutions in implementing or improving blended learning environments in technical education, highlighting the most crucial elements to increase student learning.

1.8.2 Recommendations for LMS Enhancement

This study will produce data-driven recommendations for upgrading LMS features that will assist computer science students in blended learning environments. The study will use extensive analysis to identify essential characteristics that improve usability, accessibility, and student assistance in existing LMS platforms. Instead of creating a new system, the findings will be put into a detailed report highlighting specific improvements that institutions and system developers can implement. These could include a simpler user interface, systematic content organisation, and real-time technical help. The concepts will serve as guidelines for LMS designers and educators, ensuring that the platform effectively meets blended learning requirements in technical education.

1.8 3 Increased Student Engagement in Blended Learning

This study will offer strategic insights for improving student participation in blended learning environments, particularly in computer science education. Instead of creating a new system, the findings will be offered as a structured framework for educators and instructional designers. By analysing LMS features and course structures, the study will recommend best practices such as real-time problem-solving sessions to assist students in navigating complicated technical ideas and structured collaborative projects to promote peer engagement. These guidelines will assist universities, especially UNIMAS, in improving blended learning experiences by encouraging active involvement and cooperation, ultimately leading to higher academic success.

1.8.4 Academic Performance Insights

This research is expected to provide valuable insights into the relationship between blended learning and academic performance in computer science. By examining how system quality, information quality, and service quality correlate with student outcomes, the study will clarify which LMS features have the most significant positive impacts on performance, engagement, and retention. Future course designs should prioritise aspects like simpler resource organisation or responsive support features if the study indicates that these aspects are associated with improved retention and performance. These insights will help curriculum developers and academic programs prioritise LMS features that assist technical student learning and retention.

1.9 Conclusion

This chapter introduces the study on the adoption of blended learning in computer science education, utilizing the IS Success Model and TAM frameworks. LMS emphasized as an approach to accommodate a wide range of student needs by integrating theoretical and practical learning. The problem statement identifies challenges related to system, information, and service quality that hinder effective LMS adoption. The study aims to determine key factors influencing blended learning adoption, evaluate student engagement, and analyze academic outcomes, particularly among UNIMAS students. The methodology section outlines the use of surveys and SPSS for data analysis. The chapter concludes by emphasizing the importance of the study in improving LMS features, increasing student engagement, and ultimately improving academic performance in technical education, as well as providing a timeline for expected outcomes.

1.10 Project Outline

The project is outlined into six significant chapters as below:

- **Chapter 1: Introduction**

  This chapter introduces the research background, problem statement, research questions, objectives, and significance of the study. It also outlines the scope, limitations, and organization of the report.

- **Chapter 2: Literature Review**

  This chapter presents a review of relevant literature on blended learning, LMS, the TAM, and the IS Success Model. It highlights existing research, theoretical frameworks, and identifies key gaps that inform the study's conceptual framework.

- **Chapter 3: Methodology**

  This chapter describes research design, study context, sampling strategy, instrumentation, and data collection procedures. It explains how TAM and IS Success Model were applied and outlines the analytical methods used to examine the relationships between variables.

- **Chapter 4: Results and Data Analysis**

This chapter presents the findings from the data analysis, including descriptive statistics, reliability testing, correlation analysis, regression results, and diagnostic checks. It outlines the extent to which the research hypotheses were supported.

- **Chapter 5: Discussions**

  This chapter interprets the key findings in relation to the research objectives and compares them with prior studies. It also discusses the refined model based on empirical results and explores the theoretical and practical implications of the findings.

- **Chapter 6: Conclusions and Future Works**

  The final chapter summarizes the study's objectives and key findings, outlines its academic contributions and limitations, and proposes recommendations for future research. It concludes by reflecting on the importance of LMS quality in supporting blended learning in higher education.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Blended learning (BL) has emerged as a transformative educational approach in higher education, representing a sophisticated integration of face-to-face instruction with online learning elements. According to Yu, Dai, and Wang (2023), this hybrid approach provides unprecedented flexibility in supporting wide range of learning needs, especially in technical fields like computer science. Blended learning offers a comprehensive learning strategy that extends beyond conventional pedagogical boundaries by connecting theoretical knowledge with practical abilities.

The complexity of implementing effective blended learning environments necessitates a deep understanding of technological adoption, student engagement, and educational outcomes. Anthony Jnr (2024) notes that researchers have been increasingly interested in investigating the mechanisms that enable successful BL implementation, as they have recognised its potential to revolutionise educational delivery, particularly in fields that require complex technical skills. The Technology Acceptance Model (TAM) and the Information Systems Success Model are two important theoretical frameworks that are used in this study to examine the complex dynamics of blended learning in information systems education.

2.2 Conceptualizing Blended Learning

Blended learning represents a refined pedagogical approach that strategically combines conventional classroom interactions with digital learning tools. This hybrid model preserves the interpersonal aspects of lectures in person while allowing for personalised and self-paced learning (Yu, Dai, & Wang, 2023). Blended learning provides distinct advantages in computer science education by fostering a blended learning environment that supports both theoretical instruction and practical skill development.

In higher education, a number of blended learning models have gained popularity. These models each provide distinctive ways to combine online and in-person instruction. The Flipped Classroom Model reverses typical teaching by making instructional materials available online before class, allowing in-person meetings to focus on discussions, coding exercises, and hands-on problem solving (Alyoussef, 2022). The Enriched Virtual Model ensures that students receive direct assistance while taking use of the flexibility of digital platforms by combining scheduled in-person meetings with online learning (Bervell & Arkorful, 2020).

The effectiveness of blended learning is dependent upon thoroughly addressing several critical challenges. Researchers have found some problems that make it hard to implement, such as making sure that the technology infrastructure is always consistent, delivering high-quality, relevant content, and comprehensive instructional support (Bervell & Arkorful, 2020). These challenges are especially noticeable in technical fields, where the quality of digital learning materials has a significant impact on how effectively students can learn complex skills.

2.3 Review of Technology Acceptance Model and Studies

The Technology Acceptance Model offers a comprehensive understanding of technology adoption in educational settings, focusing on user acceptance and interaction based on Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU examines the extent to which individuals believe a technological system helps to improve their performance, while PEOU evaluates the cognitive effort required to interact with the technology. According to Mohammadi (2015), TAM has been utilized widely in educational technology research to characterize how students view and interact with LMS and other technologies. Studies reveal that these elements strongly influence LMS acceptance and use in learning environments.

In blended learning, TAM provides insights into how students perceive the effectiveness of LMS platforms. For computer science students, this entails assessing digital platforms based on their capacity to handle sophisticated programming tasks, promote collaborative project management, and provide intuitive navigation (Yu, Dai, & Wang, 2023). The model shows that students' positive views on the usefulness and ease of use of technology have a significant impact on their decision to adopt and regularly utilize digital learning tools.

The model's adaptability and reliability have made it particularly valuable in educational technology research. TAM has been successfully used in studies by Mohammadi (2015) and

Estriegana, Medina-Merodio, and Barchino (2019) to analyse the adoption of blended learning techniques and LMS, demonstrating its constant significance in comprehending the use of emerging educational technology.

2.3.1 Application of TAM in Blended Learning and LMS Platform

The Technology Acceptance Model (TAM), originally developed by Davis (1989), has been widely applied to explore technology adoption in educational contexts, including Learning Management Systems (LMS) within blended learning environments. In its basic form, TAM posits that Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) shape users' Attitudes Toward Use, which then influence their Behavioral Intention to Use, and ultimately, their Actual Use of a system. This model has become foundational in understanding how students interact with educational technologies, particularly LMS platforms that serve as the backbone of blended learning delivery.

Several notable studies have extended or adapted TAM to suit specific learning contexts, especially in higher education and technical disciplines such as computer science. For example, Al-Mamary (2022) applied the standard TAM model to examine Saudi university students' adoption of LMS platforms. The study confirmed that PU and PEOU significantly predicted students' attitudes and intentions to use the LMS, validating TAM's sequential pathway from perception to behavior. This underscores that when students perceive a system as helpful and easy to use, they are more likely to engage with it regularly.

Alyoussef (2022) expanded TAM by integrating it with the Unified Theory of Acceptance and Use of Technology (UTAUT) to assess flipped classroom environments. This extended model incorporated factors such as Social Influence and Facilitating Conditions, revealing that while PU and PEOU remained influential, environmental and motivational factors also played significant roles. The findings suggest that a blended learning system's success is not only tied to its functionality but also to the broader support ecosystem that surrounds it.

Estriegana et al. (2019) proposed an enriched TAM model tailored for Online Learning Environments (OLE). Their study added constructs like Efficiency, Playfulness, and

Perceived Satisfaction, highlighting that intrinsic motivation and engaging design features can strengthen students' attitudes and usage intentions. Particularly relevant for blended and computer science education, the study emphasized how interactive and hands-on virtual tools, such as simulations and coding labs, positively influence both perceived usefulness and actual use.

In another significant contribution, Mohammadi (2015) integrated TAM with the IS Success Model to examine learners' satisfaction and intention to use e-learning platforms. The research introduced additional quality dimensions—Educational Quality, System Quality, Information Quality, and Service Quality—which were found to significantly impact both satisfaction and behavioral intention. This blended model highlights that both technical performance and educational value play pivotal roles in students' adoption of LMS tools.

Bervell and Arkorful (2020) also adopted a hybrid approach by combining TAM elements with UTAUT constructs in a study of LMS adoption in distance tertiary education. Their model emphasized Facilitating Conditions and Voluntariness of Use, showing that supportive infrastructure and the willingness to adopt technology are critical for successful LMS integration. Although their focus was on instructors, the study reinforces the importance of institutional readiness and autonomy in the adoption process, which can influence student experience as well.

These studies collectively validate TAM's utility in blended learning research while highlighting the value of extensions that include external support, user motivation, and quality measures. As summarized in Table 1, each study contributes a unique perspective by adapting TAM to different learning settings, allowing for a more comprehensive understanding of LMS adoption, particularly in digital and technical education contexts such as computer science.

Table 1 Summary of TAM Models Used in Prior Studies

Study	Model Used	Context	Key Constructs	Key Findings
Al-Mamary (2022)	TAM	LMS use among Saudi university students	PU, PEOU, Attitude, Behavioural Intention, Actual Use	PU and PEOU significantly influenced attitude and intention to use LMS.
Alyoussef (2022)	TAM + UTAUT	Flipped classrooms in higher education	PU, PEOU, Social Influence, Facilitating Conditions	PU and PEOU were significant, but external support factors also played a key role.
Estriegana et al. (2019)	Extended TAM	Online Lab Environments in blended learning	PU, PEOU, Satisfaction, Efficiency, Playfulness	Efficiency and playfulness improved PU and usage intentions; satisfaction influenced actual use.
Mohammadi (2015)	TAM + IS Success Model	E-learning system in higher education	PU, PEOU, System Quality, Service Quality, Info Quality, Educational Quality	All quality dimensions significantly influenced satisfaction and intention to use LMS.
Bervell & Arkorful (2020)	TAM + UTAUT	Distance tertiary education (LMS adoption)	Facilitating Conditions, Voluntariness of Use, Use Behaviour	Institutional and technical support influenced LMS use; voluntariness also affected behaviour.

2.3.2 Information Systems Success Model (IS Success Model)

The Information Systems Success Model is a thorough framework for assessing technological systems that was originally proposed by DeLone and McLean (1992) and refined by subsequent researchers. The three crucial characteristics of the model—system quality, information quality, and service quality—are highlighted by Atukunda, Khabusi, and Othieno (2024). These dimensions interact to assess user satisfaction, engagement, and overall technological effectiveness.

This model is particularly beneficial for the evaluation of LMS in blended learning research. Information quality assesses the relevance and clarity of educational content, system quality examines the technical functionality and reliability of digital platforms, and service quality focuses on how promptly technical and instructional assistance responds (Bervell & Arkorful, 2020). These elements are essential for developing a productive learning environment that fosters the development of both theoretical knowledge and practical skills in computer science students.

2.3.3 Common Findings and Gaps in Research

The research evaluating LMS adoption in blended learning environments revealed several significant findings. According to research by Yu, Dai, and Wang (2023) and Mohammadi (2015), perceived usefulness and perceived ease of use are the main factors influencing the adoption of LMS. According to recent research by Barz et al. (2024), when LMS platforms exhibit reliability, easy access, and user-friendly interfaces, student engagement and satisfaction levels significantly improve. Additionally, studies by Alyoussef (2022) and Wang et al. (2024) demonstrate how researchers have effectively improved TAM's predictive capacities by integrating it with supplementary frameworks like UTAUT and the IS Success Model.

However, there are still significant gaps in the state of the field. There are not many thorough studies in the sector that concentrate on computer science students, whose coursework frequently requires specialised LMS features. Even though Bervell and Arkorful (2020) started looking at the effects of system, information, and service quality, more research is required to fully comprehend how these elements affect academic performance and student engagement. Furthermore, as Alassafi (2022) points out, more empirical validation of TAM extensions would be beneficial for technical subjects in order to ensure their application in particular educational environments.

This summary of research gaps and findings indicates that although TAM offers a solid foundation for comprehending LMS adoption, there are chances to improve and expand the model for particular scenarios and academic fields.

2.4 Comparison Between Existing Technology Acceptance Model

Building upon the models discussed in Section 2.3, this section compares the foundational TAM model with two widely used extended versions to highlight their relevance and applicability to blended learning research.

2.4.1 Standard TAM Model (Davis, 1989)

The Technology Acceptance Model (TAM) is a widely used tool in educational technology research to understand the acceptance and use of Learning Management Systems (LMS) in learning environments. It focuses on user acceptance and interaction based on Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). PU measures the perceived effectiveness of a technological system, while PEOU assesses the cognitive effort required to interact with the technology. While TAM is useful, it may not fully account for factors affecting LMS adoption in blended learning, particularly when considering system, information, and service quality.

2.4.2 Extended TAM Models for LMS and Blended Learning

2.4.2.1 TAM + UTAUT (Unified Theory of Acceptance and Use of Technology)

An important theoretical advancement in comprehending LMS adoption is the combination of the Unified Theory of Acceptance and Use of Technology (UTAUT) with the Technology Acceptance Model (TAM). For example, Alyoussef's 2022 study examined this integrated framework in the setting of flipped classrooms, offering insightful information about the ways in which these models differ and complement one another.

The focus on how users perceive technology is the main area of theoretical commonality between TAM and UTAUT. Both models acknowledge that decisions about the use of technology are significantly influenced by individual attitudes and beliefs. Their integration in educational technology research is firmly based on this shared ground.

Nonetheless, there are significant differences amongst the models. There are advantages and disadvantages to UTAUT's inclusion of social influence and favourable environments as important factors influencing the adoption of technology. Even though these elements can provide more depth to analysis, they might not be as applicable in self-directed learning settings where students use LMS platforms to work independently. This restriction is especially significant in flipped classroom environments, where the focus often lies on individual interaction with the course materials rather than collaborative learning.

2.4.2.2 TAM + IS Success Model

According to Bervell and Arkorful's 2020 study, the combination of the Technology Acceptance Model (TAM) and the Information Systems Success Model provides a significant breakthrough in current understanding of LMS efficacy in blended learning settings. This combined framework recognises each model's unique analytical focus while utilising its complimentary qualities.

The quality aspects of system, information, and service quality are of vital significance to each of these models. This shared ground offers a strong basis for integration, enabling to produce more thorough understandings of LMS acceptance and implementation.

However, the models approach these quality dimensions from different perspectives. Assessing LMS performance metrics and system efficacy is the main focus of the IS Success Model. It evaluates at the system's functionality, the quality of the information it provides, and the extent of the support services offered. TAM, on the other hand, places more emphasis on the viewpoint of the user, concentrating on how people view and eventually decide to use the technology. The models have a complementary relationship as a result of their different points of emphasis.

When these methods are combined, a more thorough framework for evaluating LMS efficacy in blended learning is created. The IS Success Model gives important performance metrics and quality indicators, while TAM offers insights into user acceptability and adoption trends. Together, they provide a more thorough knowledge of the technical and human aspects that influence LMS deployment effectiveness in educational contexts.

For institutions deploying or improving their LMS platforms, this integrated approach is especially beneficial since it considers both the technical performance needs and the user adoption aspects that affect the overall success of the system. The comparative insights from these models, as well as the detailed summary presented earlier in Table 1, guide the selection of a refined framework in this study.

2.5 Key Determinants of Blended Learning Effectiveness

2.5.1 System Quality

System quality reflects the technical performance of LMS, encompassing reliability, usability, and accessibility. According to Alyoussef (2023), robust functionality, easy navigation, and seamless operation are all essential components of technical education and are assured by high-quality systems. It includes features like rapid response times, availability, and technical accuracy. This entails giving computer science students constant access to specialized learning tools and interactive programming platforms. The implications of system quality extend beyond mere technical performance. Academic outcomes, student engagement, and learning processes can all be adversely affected by poorly designed systems (Anthony Jnr, 2024). On the other hand, well-designed systems increase overall learning process management, save time, and improve access to knowledge. This study assumes that system quality enhances students' access to resources, saves time, and facilitates more effective management of learning processes. The following hypothesis is proposed and supported by previous studies:

- H1: System Quality will positively influence Perceived Usefulness of BL
- H2: System Quality will positively influence Perceived Ease of Use of BL

2.5.2 Information Quality

Information quality focuses on the fundamental elements of learning content, including accuracy, relevance, and comprehensiveness. Alyoussef (2023) argues that high-quality information is crucial in meeting educational objectives, particularly in technical fields where precision is the utmost This relates to offering thorough project documentation, in-depth programming lessons, and simulation exercises that replicate real-world situations to computer science students. Empirical research indicates that students who perceive the content of LMS as relevant and comprehensible are more likely to engage actively and achieve excellent academic performance (Anthony Jnr, 2024). The quality of information directly influences students' cognitive processes, minimizing learning barriers and enhancing comprehension. Thus, it is assumed in this study that content and information quality have a favourable outcome on PEOU and PU.

- H3: Information Quality will positively influence Perceived Usefulness of BL
- H4: Information Quality will positively influence Perceived Ease of Use of BL

2.5.3 Service Quality

Service quality refers to the level of support provided to students, including responsiveness to technical issues and the availability of resources to enhance the learning experience. Effective service quality promotes positive user experiences and minimizes disruption of the learning process. Hassan et al. (2024) argue that comprehensive support services can increase students' perception of a system's usefulness by ensuring seamless technological interactions and minimizing learning disruptions. Effective service quality promotes positive user experiences by providing timely technical assistance and resource availability, which can make students perceive the LMS as more useful and easier to use. According to Bany Mohammed et al. (2024), prompt assistance can lessen cognitive strain and make technological platforms seem more user-friendly, highlighting the need of service-technology alignment. Students are more likely to consider the blended learning system helpful for their educational performance and easy to use when they receive timely, effective support. Thus, this study hypothesized the following:

- H5: Service Quality will positively influence Perceived Usefulness of BL
- H6: Service Quality will positively influence Perceived Ease of Use of BL

2.5.4 Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)

PU refers to the extent to which a system improves students' performance. When students recognize that the LMS effectively integrates theoretical knowledge with practical application, they are more likely to adopt and engage with the system (Yu, Dai, & Wang, 2023). For example, LMS features that support interactive programming tutorials or collaborative tools may enhance the perceived usefulness of blended learning in computer science courses. PEOU reflects how effortlessly students can interact with the LMS. If the system is intuitive, with straightforward navigation and clear instructions, students are more likely to adopt and continuously use it (Mohammadi, 2015). User-friendly interfaces and well-designed features reduce cognitive load, allowing students to focus on learning rather than troubleshooting technical issues.

- H7: Perceived Usefulness will positively influence Student Satisfaction and Engagement
- H8: Perceived Ease of Use will positively influence Student Satisfaction and Engagement

2.5.5 Student Satisfaction and Engagement in Blended Learning

Student satisfaction, which is impacted by the quality of the LMS, including system performance, content relevancy, and support service responsiveness, is a critical indicator of the effectiveness of blended learning environments (Laifa, Giglou, & Akhrouf, 2023). LMS platforms meet student expectations when they offer seamless functionality, clear resources, and prompt support, which promotes positive perceptions and long-term usage. The ability of the LMS to meet practical learning needs has an impact on satisfaction in computer science education. According to Yu, Dai, and Wang (2023), characteristics like reliable system performance and relevant course materials greatly enhance overall satisfaction by encouraging motivation and engagement.

- H9: Student Satisfaction and Engagement will positively influence Student Academic Performance Improvement

2.5.6 Student Academic Performance Improvement

Blended learning environments, particularly in technical fields like computer science, have been demonstrated to enhance academic performance through the integration of face-to-face and online aspects. This balanced approach to theoretical and practical learning leads to better student outcomes (Anthony Jnr, 2024). These enhancements are a result of responsive support services, resource accessibility, and the delivery of high-quality information. According to Mohammadi (2015), students are more likely to succeed academically if they perceive their LMS is reliable and convenient to use. Collaborative exercises and self-paced learning significantly improve these results for computer science students.

2.6 Conclusion

The literature review identifies key dimensions influencing blended learning adoption and outcomes, focusing on TAM and IS Success Model frameworks. The findings highlight how crucial system, information, and service quality are in influencing students' perceptions, satisfaction, engagement, and performance. These insights guide the development of the research methodology, which applies TAM and IS Success Model frameworks to examine the adoption and effectiveness of blended learning in computer science education.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter covers the methodology for research that was utilized to examine the adoption of BL in computer science learning environments, with the use of the IS Success Model and the TAM. The research aims to determine the factors that influence the adoption of BL and how it affects student engagement and performance in the classroom. This influences the methodology utilized for collecting data. In order to effectively gather and analyze data, this study uses a quantitative design. This approach is in accordance with the study's objective of gaining practical insights to enhance BL environments.

3.2 Study Context

The research is carried out at Universiti Malaysia Sarawak (UNIMAS), concentrating on undergraduate computer science students enrolled in BL academic programs. The students engage with a Learning Management System (LMS) integrated into their academic curriculum, blending conventional classroom instruction with digital resources for teamwork, studies, and self-paced learning experiences.

The context is significant as it illustrates the rapid integration of digital resources in technical education and the various challenges endured by computer science students in adopting and engaging with BL. UNIMAS offers a well-organized BL environment, maintaining consistency and supervision over components such as course design, LMS functionalities, and instructional assistance.

3.3 Research Design

This study utilizes a quantitative research approach to examine the links between key factors like system quality, information quality, service quality and outcomes such as perceived usefulness, ease of use, engagement, satisfaction, and academic performance. The research objectives are in alignment with the quantitative approach, which facilitates precise evaluation of variables, hypothesis testing, and data analysis (Anthony Jnr, 2024). This approach ensures the development of useful insights into the factors that influence the adoption of BL in computer science education. In an effort to acquire primary data from participants, a structured survey questionnaire is handed out.

3.4 Analysis on Proposed Technology Acceptance Model

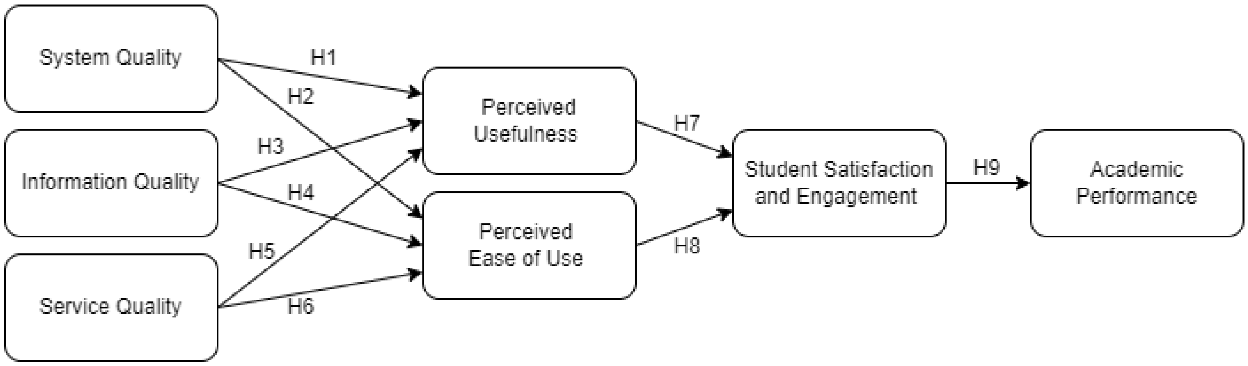


Figure 3 Research Framework

The relationships within the framework in Figure 3 reveal multiple crucial links between system components and academic outcomes. System quality, information quality, and service quality are the three aspects of quality that have the most impact on how students view the LMS in terms of its usefulness and ease of use. A reliable, user-friendly, and efficient system quality enhances the LMS's ease of use and perceived usefulness. Additionally, information quality, which includes accurate well-organized, and pertinent material, builds trust in the LMS and makes its benefits seem more significant. Students' perceptions of the LMS's usefulness and ease of use are enhanced when service quality is demonstrated through timely assistance along with helpful services.

The perceived usefulness and perceived ease of use of the LMS have a direct influence on student engagement and satisfaction. When students find that the LMS encourages them to do better in class or makes their educational experience easier, they are more likely to be satisfied with it and be actively engaged with it. Additionally, students may experience fewer challenges in terms of comprehension and engagement when the learning management system (LMS) is easy to navigate, which in turn elevates their level of satisfaction.

Students who are more engaged are more likely to make proactive contributions to learning activities, and their satisfaction with the learning management system (LMS) encourages them to continue to utilize it. Both of these factors have a positive impact on performance outcomes. Furthermore, PU and PEOU play a critical mediating role between the quality dimensions of the LMS and the student outcomes. Students' perspectives are influenced positively by the LMS high-quality features. Therefore, academic performance, engagement, and student satisfaction are all becoming more proficient.

3.5 Population and Sampling

3.5.1 Population

The study focused on computer science undergraduates at UNIMAS who are currently enrolled in courses that utilize BL. These courses merge traditional classroom instruction with online materials made available by the institution's LMS. The significance of the study comes from their hands-on experience with BL methodologies, which encompasses both theoretical and practical tasks. This demographic is selected to ensure that participants possess sufficient familiarity with the system being examined, making them ideally suited to assess its adoption and effectiveness.

3.5.2 Sampling Technique

The study utilizes a stratified random sampling method to ensure a representative sample is obtained. This method systematically categorizes individuals into several categories according to their academic levels like freshman, sophomore, junior, and senior ensuring fair distribution throughout all years of education. The students must be actively enrolled in BL courses and show consistent interaction with the LMS to fulfil the specific criteria of the sampling process to maintain data quality. Conversely, the analysis excludes students enrolled in conventional courses lacking BL or experiencing low LMS participation.

The sample size can be determined using Yamane's formula, which works well for populations with a finite number of people. The following is the formula:

$$n = \frac{N}{1 + N(e)^2}$$

where n is the sample size, N is the total population, and e is the margin of error which is typically 5% or 0.05. Considering that the computer science faculty at UNIMAS has approximately 500 undergraduate students distributed among all academic levels (freshman, sophomore, junior, and senior), and applying a 5% margin of error, the resulting calculation would be:

$$n = \frac{500}{1 + 500(0.05)^2} \approx 223$$

The computation indicates that a sample of approximately 223 students is necessary to ensure statistical validity. However, considering possible non-responses or incomplete submissions, aiming for a sample size of at least 150 students would be both practical and sufficient. This method maintains the study's feasibility while ensuring sufficient statistical power for the intended analyses. Stratified random sampling will be used to ensure that all academic levels are represented in order to gain a deeper understanding of how BL is being used throughout the different cohorts.

3.6 Participants

The study focusses on UNIMAS undergraduate computer science students adopting BL courses. Participants are selected from all academic years in order to obtain thorough insights, ranging from first-year students to seniors who have an immense amount of experience with university-level material. This varied group of participants aids in capturing the ways in which students at various academic levels engage with and learn from BL.

As computer science students, the participants offer a unique perspective to the study. Their familiarity with digital technologies and learning platforms makes them ideal for assessing blended learning's technical aspects. The majority of students have used the university's LMS for all kinds of tasks, including submitting assignments, participating in online conversations, and accessing course materials. This practical experience ensures that they can provide significant feedback regarding the system's performance and usefulness.

The study gathers demographic data from participants, such as their age, gender, and level of familiarity with online learning environments, to enhance the analysis. These details are important because they may reveal interesting tendencies, such as whether students with prior experience with similar systems find the current LMS more user-friendly, or whether various age groupings prefer specific elements of BL. This data provides a clearer picture of how various student groups adapt to and benefit from BL approaches.

The aim of this study is to provide relevant insights into BL approaches in computer science education at UNIMAS by collecting data from a wide set of participants. The findings could be particularly valuable for comprehending how to provide support for students at various academic levels throughout their educational progression.

3.7 Data Collection Methods

3.7.1 Instrumentation

The key instrument for collecting data is a structured survey questionnaire tailored to the Information Systems (IS) Success Model and the Technology Acceptance Model (TAM) components. The questionnaire is designed to assess the following dimensions:

- **System Quality:** The items measure how reliable, easy to use, and accessible the LMS is, focusing on its ability to ensure it meets user standards and delivers functionality consistently.
- **Information Quality:** The items assess the LMS learning material for clarity, relevance, and accuracy, ensuring that it helps with learning and completing assignments.
- **Service Quality:** This dimension encompasses responsiveness, availability, and the sufficiency of technical support services to resolve user issues throughout LMS utilization.

- **Perceived Usefulness (PU) and Perceived Ease of Use (PEOU):** The questions assess students' perspectives on the efficacy and ease of use of the LMS in facilitating their learning processes and fulfilling academic objectives.
- **Engagement, Satisfaction, and Academic Performance:** The items are formulated to assess students' self-reported levels of engagement, contentment with the LMS, and perceived academic outcomes derived from its use.

The survey items were adapted from validated constructs from prior studies that are in line with the IS Success Model and TAM frameworks were used. The questionnaire instrument comprises two distinct sections (Appendix A, Table A1). The first section collects demographic information from participants, including gender, academic year, and previous experience with the Learning Management System. To avoid ambiguity, the questionnaire explicitly stated that "LMS refers to eLEAP, the official Learning Management System used at UNIMAS."

The second section contains measurement items adapted from established research to ensure validity and reliability. System quality, information quality, and service quality constructs were derived from the work of Atukunda et al. (2024) and Mohammadi (2015). Perceived usefulness and perceived ease of use measurements were adapted from Anthony Jnr (2024) and Laifa et al. (2023). Engagement and satisfaction constructs were based on validated scales from Mohammadi (2015) and Laifa et al. (2023). Finally, academic performance measures were adapted from Anthony Jnr (2024) and Laifa et al. (2023) with modifications to fit the blended learning context in computer science education.

All survey items employed a standardized five-point Likert scale measurement approach. Respondents rated their level of agreement with each statement from 1 (strongly disagree) to 5 (strongly agree). Following data collection, comprehensive post-hoc reliability analysis will be conducted to ensure the internal consistency of the measurement instrument. This assessment will include Cronbach's alpha coefficients and additional reliability metrics to verify that all scale items reliably measure their intended constructs.

Additionally, the survey included three open-ended questions at the end (refer Appendix A), aimed at capturing qualitative insights into students' real-world LMS usage experiences, perceived challenges, and suggestions for improvement. These qualitative responses were used to complement the quantitative findings and provide deeper context for interpretation, particularly in the discussion of Service Quality, Engagement, and System Usability.

3.7.2 Procedure

The survey is administered online to facilitate convenient access and broad participation. The distribution is carried out via the student group chats and emails to ensure the survey reaches a wide audience within the target population.

The research employs a stratified sampling methodology to assure thorough representation of undergraduate computer science students. The target population is segmented into specific academic levels, followed by random sampling within each level. Different levels of academic maturity and experience with the university's learning management system are considered in this method, which gathers a wide range of student experiences and views on the use of BL. The stratified approach reduces potential sampling bias, which enhances the study's validity and the generalisability of its findings. This methodological selection considers differing levels of exposure and academic development.

The research follows strong ethical standards that preserve participant interests and data quality. Students are informed of the study's objectives, methods, and possible findings before taking the survey. A comprehensive informed consent process requires participants to declare their full awareness of the voluntary nature of their participation and their rights throughout the study process. In order to ensure the privacy of participants, the study design implements strict confidentiality in data handling strategies and ensures complete anonymity during data collection. No personally identifiable information is obtained or correlated with survey responses to preserve participants' privacy and collect valuable data.

The data collection phase is intended to last four to six weeks, with the goal of maximizing response rates and reducing survey fatigue. Students at different academic levels have different schedules and commitments, thus this timeframe was chosen strategically to accommodate them. Regular, well-timed reminders are distributed to encourage participation, balancing response rates and avoiding excessive interaction that may discourage participation. This systematic strategy ensures sample quality and representation throughout academic years by allowing adequate time to conduct data collection.

3.8 Data Analysis

The study analyses the data gathered and examines the relationships between the conceptual framework's constructs using SPSS software. Descriptive statistics are used at the beginning of this complex analytical process to provide a basic overview of the dataset. Demographic factors like academic level, age, gender, and previous LMS experience are examined in the analysis, which offers important insights into the sample composition and early trends across key constructs such as system quality, information quality and service quality.

Reliability testing is conducted using Cronbach’s Alpha to ensure the internal consistency of survey items. Cronbach's alpha for internal consistency will be evaluated for each construct, with a threshold value set above 0.7 to ensure the survey item’s appropriateness. This step is important for validating the survey instrument, ensuring that various items measuring the same construct are consistent.

The core analytical process involves multiple regression analysis to test the proposed associations between variables. This method investigates the relationship between independent variables like system, information, and service quality and dependent variables such as satisfaction, engagement, perceived usefulness, perceived ease of use, and academic performance. To further study the direction and degree of correlations between important variables, correlation analysis offers a deeper comprehension of their connections and any mediating impacts.

The final phase includes regression diagnostics to verify the statistical models' validity and reliability. This involves examining at R-squared values, which are a measure of the model's explanatory power and reveal how much of the variance is explained by the independent variables. The residual analysis, which verifies key model assumptions like linearity and homoscedasticity, ensuring the residuals are randomly distributed. This step helps discover any possible violations of the regression assumptions that could affect the model's accuracy, such as heteroscedasticity or autocorrelation. These diagnostic processes ensure that statistical models accurately reflect the underlying relationships in the data, increasing the trustworthiness of the research findings and subsequent recommendations.

This thorough analytical approach aims to maintain the highest standards of methodological rigour and statistical integrity while offering solid insights into the factors influencing the adoption of blended learning in computer science education.

Although the study adopts a quantitative design, responses from the open-ended questions were reviewed to support the interpretation of key statistical findings. These qualitative inputs were not subjected to formal thematic analysis but were thematically summarized to highlight common patterns. These patterns are incorporated into the discussion in Chapter 5, especially in sections related to student satisfaction, engagement, and perceived system or service challenges.

3.9 Conclusion

This chapter describes the methodological approach used to investigate the integration of BL into computer science education at UNIMAS. The study employs a quantitative research design, guided by the TAM and IS Success Model, to explore the influence of system quality, information quality, and service quality on students' perceptions, engagement, satisfaction, and academic performance. The essential elements consist of the target population, sampling techniques, data collection instruments, and analytical methods. The study uses SPSS for data analysis, focusing on descriptive statistics, reliability testing, multiple regression analysis, and correlation analysis. Reliability testing will ensure consistency, while regression diagnostics like R-squared values and residual analysis will verify model validity. These methods will provide comprehensive insights into factors influencing blended learning adoption in technical education. The findings will be presented in the next chapter.

CHAPTER 4: RESULTS AND DATA ANALYSIS

4.1 Descriptive Statistics

Descriptive statistics were computed to summarize both the demographic characteristics of respondents and their responses to all measurement items in the study. A total of 191 valid responses were analyzed.

4.1.1 Respondents' Demographic Profile

Figure 4 to Figure 7 depict the demographic distribution of the participants. The majority of the respondents were male (53.4%), with females comprising 46.6% of the sample. In terms of academic year, 45.5% were final-year students, followed by Year 2 (20.4%), Year 3 (19.4%), and Year 1 (14.7%). All respondents reported prior experience using a Learning Management System (LMS), and 69.1% used the LMS for fewer than 5 hours per week. A smaller portion (26.7%) used the LMS between 5 to 10 hours weekly, and only 4.2% used it for more than 10 hours.

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	89	46.6	46.6	46.6
	Male	102	53.4	53.4	100.0
	Total	191	100.0	100.0	

Figure 4 Respondents' Demographic Profile for Gender

Academic year

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Year 1	28	14.7	14.7	14.7
	Year 2	39	20.4	20.4	35.1
	Year 3	37	19.4	19.4	54.5
	Year 4	87	45.5	45.5	100.0
	Total	191	100.0	100.0	

Figure 5 Respondents' Demographic Profile for Academic Year

LMS usage experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	191	100.0	100.0	100.0

Figure 6 Respondents' Demographic Profile for LMS Usage Experience

Weekly LMS usage hours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-10 hours	51	26.7	26.7	26.7
	Less than 5 hours	132	69.1	69.1	95.8
	More than 10 hours	8	4.2	4.2	100.0
	Total	191	100.0	100.0	

Figure 7 Respondents' Demographic Profile for Weekly LMS Usage Hours

4.1.2 Descriptive Analysis of LMS Constructs

This section presents the descriptive statistics for each construct measured in the study. As shown in Table 2, for all items, the mean (M), standard deviation (SD), and skewness were analyzed to summarize central tendencies, variability, and the shape of the response distribution. Overall, student responses indicated generally favorable perceptions of the LMS across all constructs.

4.1.2.1 System Quality

The descriptive results for System Quality suggest that students generally perceived the LMS system features positively. The item *"I can access the LMS anytime and from anywhere"* recorded a high mean of 4.23 (SD = 0.814, Skewness = –1.098), reflecting broad agreement on system accessibility. The item *"The LMS is easy to navigate and use"* also received a strong mean of 4.27 (SD = 0.852), indicating that the majority of respondents found the platform user-friendly. However, *"The LMS is reliable and performs without frequent errors"* had a slightly lower mean of 3.90 (SD = 0.906), suggesting some respondents may have experienced inconsistencies in system performance. All items under this construct showed negative skewness, indicating that responses tended to lean toward higher levels of agreement.

4.1.2.2 Information Quality

Items measuring Information Quality yielded consistently high mean scores, with relatively low variation. The highest-rated item was *"The information on the LMS is organized and easy to understand"* (M = 4.28, SD = 0.721), followed by *"The course materials on the LMS are relevant to my academic needs"* (M = 4.14, SD = 0.737) and *"The LMS provides sufficient detail in course content to support my learning"* (M = 4.14, SD = 0.779). These findings suggest that students generally perceived the LMS content to be well-organized and academically useful. Skewness values for this construct were all negative, reflecting a left-tailed distribution and high consensus toward agreement.

4.1.2.3 Service Quality

Compared to other constructs, Service Quality items showed slightly more variability in responses. The item *"I receive prompt assistance when I face technical issues with the LMS"* had the lowest mean across the dataset at 3.68 (SD = 0.993), suggesting room for improvement in technical support responsiveness. Conversely, more favorable responses were observed for items like *"The instructional support provided (e.g., tutorials or FAQs) meets my needs"* (M = 4.01, SD = 0.861) and *"I feel supported when using the LMS for blended learning"* (M = 4.03, SD = 0.778). While students appear generally satisfied with instructional guidance, technical support remains a potential area for enhancement.

4.1.2.4 Perceived Usefulness

The results for Perceived Usefulness indicate that students largely agreed that the LMS supports their academic productivity. The highest mean was observed for *"The LMS helps me complete my coursework more efficiently"* (M = 4.37, SD = 0.789), followed by *"I find the LMS useful for managing my time and learning tasks"* (M = 4.27, SD = 0.793). Other items, including *"The LMS improves my understanding of the course content"* (M = 4.19, SD = 0.703), also scored well. All items had skewness values ranging from –0.647 to –1.052, reflecting consistent positive perceptions among students.

4.1.2.5 Perceived Ease of Use

Students reported high levels of agreement with statements related to the usability of the LMS. The items *"Learning how to use the LMS was straightforward"* and *"The LMS interface is intuitive and simple to use"* both recorded the highest mean scores of 4.30 (SD = 0.755 and 0.727, respectively). The item *"The LMS requires minimal effort to accomplish learning tasks"* also showed a high mean of 4.26 (SD = 0.743). These findings highlight that students perceive the LMS as accessible and easy to use. The slightly negative skewness values indicate that a majority of students rated their experiences on the higher end of the scale.

4.1.2.6 Student Satisfaction and Engagement

Satisfaction and Engagement items showed strong agreement, suggesting that students felt positively about their LMS experiences. The item *"The LMS keeps me engaged with my coursework"* had a mean of 4.15 (SD = 0.742), while *"Overall, I am satisfied with my blended learning experience using the LMS"* also scored highly (M = 4.13, SD = 0.746). These results suggest that students were both engaged and satisfied, likely due to effective LMS functionality and content delivery. Skewness values were moderately negative, reinforcing that the majority of responses were favorable.

4.1.2.7 Academic Performance

Items related to academic performance were among the highest rated across all constructs. *"My ability to complete assignments has improved with blended learning"* showed a mean of 4.20 (SD = 0.685), and *"The LMS contributes to my academic growth and overall performance"* recorded M = 4.15 (SD = 0.742). The responses indicate that students believe the LMS plays a meaningful role in supporting their academic development. The relatively low standard deviations and negative skewness values further emphasize the consistency of positive responses in this category.

Table 2 Descriptive Statistics

Descriptive Statistics

	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Deviation Statistic	Skewness Statistic	Skewness Std. Error
The LMS is easy to navigate and use.	191	1	5	4.27	.852	-1.019	.176
The LMS is reliable and performs without frequent errors.	191	1	5	3.90	.906	-.607	.176
The LMS allows me to engage actively in classes.	191	1	5	4.17	.879	-1.040	.176
I can access the LMS anytime and from anywhere.	191	1	5	4.23	.814	-1.098	.176
The LMS provides a user-friendly interface for completing course-related tasks.	191	1	5	4.17	.810	-.676	.176
The content provided through the LMS is accurate and helpful.	191	1	5	4.13	.771	-1.055	.176
The course materials on the LMS are relevant to my academic needs.	191	1	5	4.14	.737	-.708	.176
The information on the LMS is organized and easy to understand.	191	1	5	4.28	.721	-.910	.176
The LMS provides sufficient detail in course content to support my learning.	191	1	5	4.14	.779	-.928	.176
The materials on the LMS align with the objectives of my computer science courses.	191	1	5	4.04	.800	-.885	.176
I receive prompt assistance when I face technical issues with the LMS.	191	1	5	3.68	.993	-.787	.176
The technical support staff are knowledgeable and helpful.	191	1	5	3.85	.878	-.593	.176
The instructional support provided (e.g., tutorials or FAQs) meets my needs.	191	1	5	4.01	.861	-.709	.176
I feel supported when using the LMS for blended learning.	191	1	5	4.03	.778	-.724	.176
The availability of support services improves my learning experience.	191	1	5	4.01	.846	-.705	.176

The LMS improves my understanding of the course content.	191	2	5	4.19	.703	-.382	.176
The LMS helps me complete my coursework more efficiently.	191	1	5	4.37	.789	-1.207	.176
Using the LMS enhances my academic performance.	191	2	5	4.19	.785	-.676	.176
I find the LMS useful for managing my time and learning tasks.	191	2	5	4.27	.793	-.772	.176
Learning how to use the LMS was straightforward.	191	2	5	4.30	.755	-.717	.176
The LMS requires minimal effort to accomplish learning tasks.	191	2	5	4.29	.793	-.767	.176
I can quickly find the resources I need on the LMS.	191	2	5	4.19	.732	-.401	.176
The LMS interface is intuitive and simple to use.	191	2	5	4.30	.727	-.620	.176
The LMS keeps me engaged with my coursework.	191	1	5	4.15	.742	-.720	.176
I feel motivated to participate in blended learning activities using the LMS.	191	1	5	4.04	.817	-.888	.176
The LMS facilitates collaboration with peers (e.g., group projects).	191	1	5	4.04	.823	-.755	.176
The LMS meets my expectations for a productive learning environment.	191	1	5	4.05	.810	-1.048	.176
Overall, I am satisfied with my blended learning experience using the LMS.	191	1	5	4.13	.746	-.832	.176
Blended learning has positively impacted my grades in computer science courses.	191	1	5	4.07	.733	-.674	.176
I feel more confident in applying theoretical knowledge through LMS resources.	191	1	5	4.01	.771	-.426	.176
The LMS has improved my practical skills (e.g., problem-solving).	191	2	5	4.08	.760	-.568	.176
My ability to complete assignments has improved with blended learning.	191	2	5	4.20	.685	-.384	.176
The LMS contributes to my academic growth and overall performance.	191	1	5	4.15	.742	-.955	.176
Valid N (listwise)	191						

4.2 Reliability Testing

To ensure the reliability and consistency of the research instrument, internal consistency was assessed using Cronbach's Alpha, which measures how closely related a set of items are within each construct. According to Hair et al. (2010), Cronbach's Alpha value of 0.70 or above is considered acceptable, indicating that the scale is reliable.

The measurement items in this study were adapted from previously validated studies, including works by Mohammadi (2015), Bokolo Anthony Jr. (2024), Laifa et al. (2023), and others, to align with the context of blended learning in computer science education. Table 3 summarizes the Cronbach's Alpha results for each of the seven main constructs. All constructs exceeded the 0.70 threshold, with values ranging from 0.872 to 0.894, demonstrating strong internal consistency.

Table 3 Reliability Test Results

	Reliability Statistics	
	Cronbach's Alpha	N of Items
System Quality	.880	5
Information Quality	.885	5
Service Quality	.874	5
Perceived Usefulness	.894	4
Perceived Ease of Use	.872	4
Student Satisfaction & Engagement	.890	5
Academic Performance	.884	5

These results indicate that all scales are statistically reliable and consistent, justifying their use for further statistical analysis. The use of adapted and previously validated instruments strengthens the construct validity of this study and supports confidence in interpreting the findings from subsequent correlation and regression analysis.

4.3 Correlation Analysis

Pearson's correlation coefficient was used to examine the strength and direction of linear relationships between key independent and dependent variables in this study. The analysis was guided by the nine hypotheses (H1–H9) developed based on the proposed Blended Learning Adoption Model. The correlation coefficient (r) values range from –1 to +1, with values closer to +1 indicating a strong positive relationship. A 2-tailed test was applied, and relationships with p-values below 0.01 were considered statistically significant. The following sections describe the correlation results for each dependent variable in detail.

4.3.1 Perceived Usefulness (PU)

To test H1, H3, and H5, the correlation between System Quality, Information Quality, Service Quality (IVs) and Perceived Usefulness (DV) was assessed. The results in Table 4 showed all three predictors were significantly and positively correlated with PU:

- System Quality and PU ($r = .631, p < .001$)
- Information Quality and PU ($r = .623, p < .001$)
- Service Quality and PU ($r = .559, p < .001$)

These findings suggest that students who perceive the LMS as easy to navigate, technically reliable, and filled with relevant, well-organized content also perceive it as more useful. Although Service Quality had the weakest correlation among the three, the result still supports a positive relationship, consistent with H5.

Table 4 Correlation Between LMS Quality and Perceived Usefulness

Correlations

		System_Quality	Information_Quality	Service_Quality	Perceived_Usefulness
System_Quality	Pearson Correlation	1	.827**	.711**	.631**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	191	191	191	191
Information_Quality	Pearson Correlation	.827**	1	.720**	.623**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	191	191	191	191
Service_Quality	Pearson Correlation	.711**	.720**	1	.559**
	Sig. (2-tailed)	<.001	<.001		<.001
	N	191	191	191	191
Perceived_Usefulness	Pearson Correlation	.631**	.623**	.559**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	191	191	191	191

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

4.3.2 Perceived Ease of Use (PEOU)

To evaluate H2, H4, and H6, correlations were calculated between System Quality, Information Quality, Service Quality (IVs) and Perceived Ease of Use (DV). Results in Table 5 showed strong, positive, and significant correlations:

- System Quality and PEOU ($r = .669$, $p < .001$)
- Information Quality and PEOU ($r = .634$, $p < .001$)
- Service Quality and PEOU ($r = .540$, $p < .001$)

This indicates that students find the LMS easier to use when it is technically reliable and when its content is clearly structured. The relatively lower correlation for Service Quality again suggests that external support plays a lesser role in shaping perceptions of ease of use among students, particularly in a computer science context.

Table 5 Correlation Between LMS Quality and Perceived Ease of Use

Correlations

		System_Quality	Information_Quality	Service_Quality	Perceived_Ease_of_Use
System_Quality	Pearson Correlation	1	.827**	.711**	.669**
	Sig. (2-tailed)		<.001	<.001	<.001
	N	191	191	191	191
Information_Quality	Pearson Correlation	.827**	1	.720**	.634**
	Sig. (2-tailed)	<.001		<.001	<.001
	N	191	191	191	191
Service_Quality	Pearson Correlation	.711**	.720**	1	.540**
	Sig. (2-tailed)	<.001	<.001		<.001
	N	191	191	191	191
Perceived_Ease_of_Use	Pearson Correlation	.669**	.634**	.540**	1
	Sig. (2-tailed)	<.001	<.001	<.001	
	N	191	191	191	191

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

4.3.3 Student Satisfaction and Engagement

For H7 and H8, the relationships between Perceived Usefulness and Ease of Use (IVs) and Student Satisfaction and Engagement (DV) were tested. Both variables as shown in Table 6 demonstrated significant and positive correlations with Satisfaction and Engagement:

- PU and Satisfaction & Engagement ($r = .686$, $p < .001$)

- PEOU and Satisfaction & Engagement ($r = .615$, $p < .001$)

These results support the assumption that students who perceive the LMS as both useful and easy to use are more likely to feel satisfied and engaged with their learning experience. PU had a slightly stronger association than PEOU, suggesting that functional value may matter more than ease of navigation alone.

Table 6 Correlation Between PU, PEOU and Student Satisfaction & Engagement

Correlations

		Perceived_Usefulness	Perceived_Ease_of_Use	Student_Satisfaction_Engagement
Perceived_Usefulness	Pearson Correlation	1	.838**	.686**
	Sig. (2-tailed)		<.001	<.001
	N	191	191	191
Perceived_Ease_of_Use	Pearson Correlation	.838**	1	.615**
	Sig. (2-tailed)	<.001		<.001
	N	191	191	191
Student_Satisfaction_Engagement	Pearson Correlation	.686**	.615**	1
	Sig. (2-tailed)	<.001	<.001	
	N	191	191	191

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

4.3.4 Academic Performance

Lastly, H9 was tested by examining the correlation between Student Satisfaction & Engagement and Academic Performance. The results in Table 7 showed a strong, positive, and highly significant correlation:

- Satisfaction & Engagement and Academic Performance ($r = .793$, $p < .001$)

This result indicates that students who are more engaged and satisfied with their LMS experience are more likely to perform well academically. The high correlation value emphasizes the critical role of learner experience as a driver of academic outcomes in blended learning environments.

Table 7 Correlation Between Satisfaction & Engagement and Academic Performance

Correlations

		Student_Satisfaction_Engagement	Academic_Performance
Student_Satisfaction_Engagement	Pearson Correlation	1	.793**
	Sig. (2-tailed)		<.001
	N	191	191
Academic_Performance	Pearson Correlation	.793**	1
	Sig. (2-tailed)	<.001	
	N	191	191

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

4.4 Regression Analysis

Multiple regression analysis was conducted to test the nine research hypotheses across four models. Each model corresponded to a specific dependent variable: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Student Satisfaction & Engagement (SSE), and Academic Performance (AP). The goal was to determine the effect of various LMS quality factors and user perceptions on these outcome variables. Statistical assumptions were checked, and the Durbin-Watson values indicated no autocorrelation in any model.

4.4.1 Model 1: Predicting Perceived Usefulness

The first model examined the extent to which System Quality, Information Quality, and Service Quality predicted students' Perceived Usefulness of the LMS. The model was statistically significant, $F(3, 187) = 49.193$, $p < .001$, with an R^2 value of 0.441 (refer Appendix B, Table B1 and Table B2). This indicates that approximately 44.1% of the variance in Perceived Usefulness could be explained by the three independent variables. The Durbin-Watson value of 1.614 suggested no violation of autocorrelation assumptions.

Among the predictors as shown in Table 8, both System Quality ($\beta = .312$, $p = .002$) and Information Quality ($\beta = .253$, $p = .015$) were statistically significant. These findings suggest that students who perceive the LMS as reliable and its content as well-structured are more likely to find it useful. Meanwhile, Service Quality showed a marginal effect ($\beta = .155$, $p = .062$), indicating a weaker influence on PU.

These results support H1 and H3 but not H5. System and content quality significantly shape students' perceptions of how helpful the LMS is in completing academic tasks. This supports the foundational premise of the IS Success Model and previous studies highlighting the importance of both technical and informational aspects of LMS platforms.

Table 8 Regression Coefficients – Predicting Perceived Usefulness

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	1.336	.247		5.397	<.001		
	System_Quality	.298	.097	.312	3.067	.002	.288	3.471
	Information_Quality	.268	.110	.253	2.446	.015	.280	3.567
	Service_Quality	.146	.077	.155	1.879	.062	.439	2.275

a. Dependent Variable: Perceived_Usefulness

4.4.2 Model 2: Predicting Perceived Ease of Use

The second regression model assessed the impact of System Quality, Information Quality, and Service Quality on Perceived Ease of Use. The overall model was statistically significant, $F(3, 187) = 55.287$, $p < .001$, with an R^2 value of 0.470 (refer Appendix B, Table B3 and Table B4), indicating that 47.0% of the variance in PEOU was explained by the predictors. The Durbin-Watson statistic was 1.686, falling within the acceptable range.

As depicted in Table 9, System Quality emerged as the strongest predictor ($\beta = .430$, $p < .001$), indicating that technical stability, accessibility, and usability are crucial for students to perceive the LMS as easy to use. Information Quality also had a significant effect ($\beta = .227$, $p = .025$), suggesting that well-organized and understandable content contributes to ease of use. However, Service Quality was not a significant predictor ($\beta = .071$, $p = .379$).

These results support H2 and H4 but not H6. The findings reaffirm the TAM framework, which posits that user-friendly and well-designed systems lead to greater ease of use. The non-significant role of service support indicates that ease of use is largely dependent on system and content design rather than external assistance.

Table 9 Regression Coefficients – Predicting Perceived Ease of Use

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	1.439	.230		6.246	<.001		
	System_Quality	.393	.091	.430	4.340	<.001	.288	3.471
	Information_Quality	.230	.102	.227	2.258	.025	.280	3.567
	Service_Quality	.064	.072	.071	.882	.379	.439	2.275

a. Dependent Variable: Perceived_Ease_of_Use

4.4.3 Model 3: Predicting Student Satisfaction and Engagement

The third model tested whether Perceived Usefulness and Perceived Ease of Use predicted Student Satisfaction and Engagement. The regression was significant, $F(2, 188) = 85.347$, $p < .001$ (refer Appendix B, Table B5 and Table B6), and explained 47.6% of the variance ($R^2 = .476$). The Durbin-Watson value of 1.743 again confirmed that residuals were independent.

Among the predictors as illustrated in Table 10, only Perceived Usefulness was statistically significant ($\beta = .574$, $p < .001$), while Perceived Ease of Use did not have a significant effect ($\beta = .134$, $p = .169$). This indicates that students who find the LMS helpful for completing academic work are more likely to be satisfied and engaged, even if the platform is not particularly easy to use.

Therefore, H7 is supported, and H8 is not. These findings align with the TAM perspective that usefulness is a stronger driver of satisfaction and engagement compared to ease of use, especially in user populations familiar with digital tools.

Table 10 Regression Coefficients – Predicting Student Satisfaction and Engagement

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	1.097	.239		4.586	<.001		
	Perceived_Usefulness	.564	.095	.574	5.930	<.001	.297	3.362
	Perceived_Ease_of_Use	.137	.099	.134	1.380	.169	.297	3.362

a. Dependent Variable: Student_Satisfaction_Engagement

4.4.4 Model 4: Predicting Academic Performance

The final model explored whether Student Satisfaction and Engagement significantly predicted Academic Performance. The model was highly significant, $F(1, 189) = 319.786$, $p < .001$, with an R^2 of 0.629 (refer Appendix B, Table B7 and Table B8). This means that satisfaction and engagement alone explained 62.9% of the variance in academic performance. The Durbin-Watson statistic was 1.967, indicating no autocorrelation.

Table 11 shows Student Satisfaction and Engagement was a strong and significant predictor ($\beta = .793$, $p < .001$), confirming that students who are more engaged and satisfied with their LMS experience are more likely to report higher academic performance.

This supports H9 and confirms the mediating role of satisfaction and engagement in the blended learning environment. The results suggest that affective and motivational engagement with LMS tools directly contributes to academic success.

Table 11 Regression Coefficients – Predicting Academic Performance

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.	Collinearity Statistics Tolerance	Collinearity Statistics VIF
1	(Constant)	1.094	.170		6.422	<.001		
	Student_Satisfaction_Engagement	.737	.041	.793	17.883	<.001	1.000	1.000

a. Dependent Variable: Academic_Performance

4.4.5 Hypothesis Testing Summary

The research framework tested nine hypotheses (H1–H9) derived from the integration of the Technology Acceptance Model (TAM) and the Information Systems Success Model (ISSM). These hypotheses explored the relationships between LMS quality factors (System Quality, Information Quality, Service Quality), user perceptions (Perceived Usefulness and Perceived Ease of Use), and student outcomes (Satisfaction & Engagement and Academic Performance). The hypotheses were evaluated through four multiple regression models.

Table 12 summarizes the results of hypothesis testing, presenting the standardized beta coefficients (β), significance values (p-values), and the conclusion for each hypothesis.

Table 12 Hypothesis Testing

Hypothesis	Β (Standardized)	p-value	Result
H1	.312	.002	Supported
H2	.430	< .001	Supported
H3	.253	.015	Supported
H4	.227	.025	Supported
H5	.155	.062	Not Supported
H6	.071	.379	Not Supported
H7	.574	< .001	Supported
H8	.134	.169	Not Supported
H9	.793	< .001	Supported

Overall, six of the nine hypotheses were supported. The results confirmed that both System Quality and Information Quality significantly influence Perceived Usefulness and Ease of Use. Service Quality, however, was not a significant predictor in either case, suggesting that support mechanisms may play a less prominent role for this student group.

Additionally, Perceived Usefulness emerged as a key driver of Satisfaction and Engagement, while Ease of Use did not show a significant effect. Finally, Satisfaction and Engagement had the strongest predictive relationship with Academic Performance, supporting the idea that engaged and satisfied students tend to perform better academically. These results offer empirical support for the blended learning adoption model proposed in Chapter 1 and align well with the theoretical foundations presented in Chapter 2.

4.5 Regression Diagnostics

To ensure the validity of the regression analyses, several diagnostic tests were performed to verify the assumptions of linear regression: multicollinearity, independence of residuals, and normality and homoscedasticity of residuals.

4.5.1 Multicollinearity

Multicollinearity was assessed using Tolerance and Variance Inflation Factor (VIF) values for all four models. As shown in Table 13, all Tolerance values were greater than 0.1 and all VIF values were below the commonly accepted threshold of 5. Specifically, VIF values ranged from 1.000 to 3.567 across models, confirming that multicollinearity was not a concern. These results indicate that the predictor variables are sufficiently independent and that their individual contributions to the models can be reliably interpreted.

Table 13 VIF and Tolerance Values Summary

Model	Predictor	Tolerance	VIF
Model 1(DV: Perceived Usefulness)	System Quality	0.288	3.471
	Information Quality	0.280	3.567
	Service Quality	0.439	2.275
Model 2(DV: Perceived Ease of Use)	System Quality	0.288	3.471
	Information Quality	0.280	3.567
	Service Quality	0.439	2.275
Model 3(DV: Satisfaction & Engagement)	Perceived Usefulness	0.297	3.362
	Perceived Ease of Use	0.297	3.362
Model 4(DV: Academic Performance)	Satisfaction & Engagement	1.000	1.000

4.5.2 Independence of Residuals

To test the independence of residuals, the Durbin-Watson statistic was used in each regression model. The Durbin-Watson values ranged from 1.614 to 1.967, which fall within the acceptable range of 1.5 to 2.5, indicating that the residuals were not autocorrelated. This confirms the assumption of independence and supports the integrity of the regression results.

Durbin–Watson values for each model are reported in the model summary tables in Appendix B.

4.5.3 Normality and Homoscedasticity of Residuals

Normal probability plots (P–P plots) and standardized residual scatterplots were examined to assess the assumptions of normality, linearity, and homoscedasticity. In each model:

- The P–P plots showed that residuals closely followed the diagonal reference line, suggesting an approximately normal distribution.
- The scatterplots of standardized residuals versus predicted values revealed a random, evenly dispersed cloud of points with no discernible patterns, supporting the assumptions of linearity and homoscedasticity.

These diagnostic plots are provided in Appendix C and together indicate that the assumptions of normality, linearity, and equal variance of residuals were adequately met in all four regression models.

4.6 Conclusion

This chapter presented a comprehensive analysis of the data collected from 191 UNIMAS Computer Science students. Descriptive statistics revealed generally favorable student perceptions of LMS quality, usefulness, usability, and its impact on academic performance. Reliability testing confirmed that all constructs had high internal consistency, supporting the validity of the measurement model. Correlation analysis indicated strong and significant relationships among LMS quality factors, perceived usefulness and ease of use, satisfaction, engagement, and academic performance. Multiple regression analysis further validated six out of nine proposed hypotheses, highlighting the central role of System and Information Quality in predicting student perceptions, and the critical influence of Perceived Usefulness and Satisfaction & Engagement on academic outcomes. Regression diagnostics confirmed the appropriateness of the models, with no violations of key assumptions. These findings collectively support the proposed Blended Learning Adoption Model and provide a statistically robust foundation for the interpretations discussed in the following chapter.

CHAPTER 5: DISCUSSION

5.1 Introduction

This chapter presents a detailed interpretation of the study's findings in relation to the proposed hypotheses, research objectives, and established literature. Guided by the TAM and the IS Success Model, the discussion explores how key LMS quality dimensions like System Quality, Information Quality and Service Quality influence students' perceptions of usefulness and ease of use, and how these perceptions affect satisfaction, engagement, and academic performance. The analysis also considers the unique context of Computer Science students, who typically possess higher digital literacy and greater familiarity with online systems, to help explain specific patterns in the results. In addition, this chapter introduces a refined research framework based on empirical evidence and concludes by outlining both theoretical and practical implications. Each hypothesis is discussed in detail, with comparisons to prior studies to support interpretation and highlight the study's contributions.

5.2 Summary of Key Findings

The study tested nine hypotheses (H1–H9) through four regression models, with six hypotheses supported and three not supported. The results showed that System Quality and Information Quality significantly influenced both Perceived Usefulness and Perceived Ease of Use, while Service Quality did not have a meaningful impact on either. Perceived Usefulness emerged as a key driver of Student Satisfaction and Engagement, whereas Perceived Ease of Use showed no significant effect. Finally, Satisfaction and Engagement was the strongest predictor of Academic Performance. These findings highlight the importance of system reliability, content quality, and student engagement as critical factors in promoting academic success in blended learning environments.

5.3 Discussion by Research Hypotheses

5.3.1 H1 & H2: System Quality as a Predictor of Usefulness and Ease of Use

The results from this study showed that System Quality significantly predicted both Perceived Usefulness ($\beta = .312$, $p = .002$) and Perceived Ease of Use ($\beta = .430$, $p < .001$), thus supporting both H1 and H2. These findings highlight that for computer science students, the technical stability, responsiveness, and user-friendliness of the LMS directly influence not only how beneficial they find the system but also how easy it is to operate. This is likely due to the students' familiarity with digital systems and their higher expectations regarding system performance. As users with strong technical backgrounds, they are more attuned to evaluating system efficiency and reliability, which aligns with the Technology Acceptance Model (Davis, 1989), where system usability significantly shapes both perceived ease and usefulness.

This result is consistent with the work of Anthony Jnr (2024), who emphasized that system functionality is a critical success factor in blended learning adoption. Similarly, Delone and McLean's IS Success Model (2003) also highlights System Quality as a foundational element influencing user perceptions. Open-ended responses from this study further reinforce this view—students appreciated features such as centralized content access, intuitive navigation, and responsive performance. For example, many students mentioned that the LMS helps them track assignments and access learning materials conveniently, which directly connects to their sense of ease and utility. Overall, these findings underline the importance of designing LMS platforms that are not only functional but also technically reliable for digitally literate users such as computer science students.

5.3.2 H3 & H4: Information Quality and Its Effect on Perceptions

Information Quality was found to significantly predict both Perceived Usefulness ($\beta = .253$, $p = .015$) and Perceived Ease of Use ($\beta = .227$, $p = .025$), confirming H3 and H4. These results suggest that well-organized, accurate, and relevant course content plays a crucial role not only in helping students perceive the LMS as valuable for their academic tasks but also in reducing the cognitive load associated with navigating and using the system.

For computer science students, clear and structured content is especially vital due to the technical and layered nature of their courses. Students in this field often engage with complex topics that require precision, logical progression, and practical application. As indicated in the open-ended responses, features like organized modules, step-by-step tutorials, and centralized access to materials were seen as particularly helpful. Many students specifically highlighted that having all learning resources—including slides, videos, assignments, and quizzes—in one place saved time and improved their ability to manage their studies efficiently.

These findings are aligned with previous research by Mohammadi (2015) and Al-Busaidi & Al-Shihi (2010), who noted that information clarity and relevance are key drivers of perceived usefulness in e-learning environments. Additionally, this supports the IS Success Model, which positions Information Quality as a fundamental component influencing user satisfaction and system use.

Importantly, the strong perception of information quality among the respondents suggests that when LMS content is logically structured and academically relevant, students not only feel more supported in their coursework but also find the system easier to use—even without needing extensive support services. This makes content design a high-priority area for LMS enhancement, especially in technical disciplines like computer science.

5.3.3 H5 & H6: Service Quality and Its Limited Role in LMS Evaluation

In contrast to expectations, Service Quality was not a significant predictor of either Perceived Usefulness ($\beta = .155$, $p = .062$) or Perceived Ease of Use ($\beta = .071$, $p = .379$), resulting in the rejection of both H5 and H6. These findings suggest that technical or instructional support services—such as help desks, FAQs, or tutorials—were not influential in shaping how students perceived the LMS's value or ease of use.

This outcome is particularly understandable within the context of computer science students, who are typically more self-reliant and digitally literate. Many of these students are confident in troubleshooting minor issues independently or rely on peer support rather than formal assistance channels. Open-ended responses reinforce this view: several students reported rarely using available support features and emphasized their preference for intuitive design and direct access to materials over external help. As one respondent noted, "If I have problems, I just ask classmates or figure it out."

These findings are consistent with previous studies, such as those by Antwi-Boampong and Bokolo (2021), which found that in digitally proficient student populations, Service Quality has a diminished role in LMS evaluation. Al-Fraihat et al. (2020) similarly observed that support services only become influential when they are both frequently used and perceived as impactful—conditions that may not apply in this study, given the respondents' confidence with technology.

Overall, the limited role of Service Quality in this context suggests that efforts to enhance LMS platforms for computer science students should prioritize improving system functionality and content design, rather than investing heavily in support services that are underutilized by this user group.

5.3.4 H7 & H8: Usefulness vs. Usability in Driving Satisfaction and Engagement

The analysis revealed that Perceived Usefulness was a significant predictor of Student Satisfaction and Engagement ($\beta = .574$, $p < .001$), while Perceived Ease of Use was not ($\beta = .134$, $p = .169$). Thus, H7 was supported and H8 was not. These findings reinforce the idea that students are more engaged and satisfied with a system they perceive as valuable to their academic performance, even if the system isn't perfectly easy to use.

For computer science students in particular, this result is expected. As digital natives with advanced technical backgrounds, many of them likely have a high threshold for usability and consider ease of use a baseline expectation rather than a major deciding factor. What matters more is whether the LMS helps them achieve academic goals—such as organizing learning materials, completing assignments efficiently, or accessing learning tools that align with their course objectives.

These findings support Davis's (1989) Technology Acceptance Model (TAM), which posits that Perceived Usefulness has a stronger and more direct influence on user behavior than Ease of Use, especially among experienced users. Šumak et al. (2011) also found that in user groups familiar with e-learning platforms, usability does not necessarily lead to higher satisfaction unless the system is especially difficult to use—which was not the case in this study.

Qualitative feedback from students further supports this pattern. Many responses highlighted that features such as centralized course access, progress tracking, and availability of materials were “most helpful” in their LMS use. In contrast, few students mentioned system simplicity as a major contributor to their satisfaction, reinforcing the notion that usefulness—rather than just user-friendliness—drives LMS engagement among this demographic.

In summary, this study adds to existing evidence that functionality and academic value are more critical than ease of use in influencing satisfaction and engagement, particularly among technically competent student groups.

5.3.5 H9: Satisfaction and Engagement as Predictors of Academic Performance

The final model tested the relationship between Student Satisfaction and Engagement and Academic Performance, revealing a strong and statistically significant effect ($\beta = .793$, $p < .001$). This supports H9 and confirms that students who are more engaged and satisfied with their LMS experience tend to perform better academically.

This finding is particularly relevant in the context of computer science education, where independent learning, continuous access to resources, and real-time feedback are crucial for success. When students feel connected to their learning environment and perceive the LMS as effective and motivating, they are more likely to persist in coursework, complete assignments on time, and apply theoretical knowledge—factors that directly impact academic outcomes.

The strength of this relationship aligns with the work of Laifa et al. (2023), who found that engagement is a strong predictor of academic success in blended learning environments. It also supports the Information Systems Success Model (DeLone & McLean, 2003), which highlights the importance of user satisfaction and system use in achieving positive organizational outcomes, including learning results.

Open-ended responses from students further reinforce this finding. Many mentioned that features like progress tracking, timely access to materials, and structured course modules helped them stay motivated and organized. Several also indicated that LMS tools such as discussion forums, recorded lectures, and assignment reminders supported their academic tasks and helped them perform better.

In contrast, when satisfaction and engagement are low—due to poor content organization, system instability, or lack of interactive features—students may become disengaged, which negatively affects learning outcomes. Therefore, improving the affective and behavioral aspects of LMS use is not just a matter of user experience but also a strategic priority for enhancing academic performance.

In conclusion, the findings establish a clear link between student engagement with the LMS and their academic achievement, supporting the role of blended learning platforms as key enablers of educational success in technical disciplines.

5.4 Refined Model Based on Empirical Findings

Following the hypothesis testing, a refined version of the original research framework was developed to visually represent the validated relationships among the constructs. This updated model integrates the empirical findings from the four regression analyses and reflects which hypothesized paths were statistically supported.

As illustrated in Figure 8, black arrows denote the supported hypotheses, while red arrows indicate relationships that were not statistically significant. Of the nine hypotheses tested, six were supported, revealing key insights into how Learning Management System (LMS) quality and user perceptions influence student satisfaction, engagement, and academic performance in a blended learning environment.

Key relationships supported in the refined model include:

- The influence of System Quality on both Perceived Usefulness and Perceived Ease of Use.
- The effect of Information Quality on Perceived Usefulness and Ease of Use.
- The significant role of Perceived Usefulness in predicting Student Satisfaction and Engagement.
- The strong predictive effect of Satisfaction and Engagement on Academic Performance.

Conversely, Service Quality did not significantly influence Perceived Usefulness or Ease of Use, and Ease of Use itself was not a significant predictor of satisfaction or engagement. These unsupported paths, marked in red, highlight areas where assumptions based on previous models may not fully apply within the context of computer science students—who often exhibit high digital fluency and self-directed learning behaviours.

The refined model serves as a validated, evidence-based framework for understanding LMS adoption and its academic implications in technical education. It not only reflects the reality of how students interact with LMS features but also offers a diagnostic tool for institutions aiming to enhance the effectiveness of blended learning implementations.

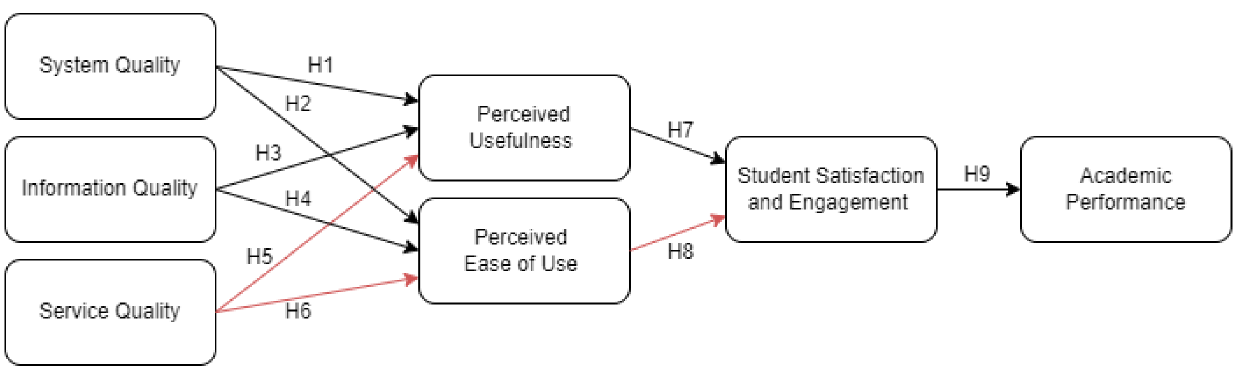


Figure 8 Refined Blended Learning Adoption Model Based on Hypothesis Testing

5.5 Implications of the Findings

5.5.1 Theoretical Implications

The findings of this study reinforce the relevance of integrating the Technology Acceptance Model (TAM) and the Information Systems Success Model (ISSM) to understand blended learning adoption in technical education. In particular, the strong influence of Perceived Usefulness over Ease of Use on student Satisfaction and Engagement supports Davis' (1989) original TAM proposition that usefulness has a more direct impact on user attitudes. Additionally, the results validate System Quality and Information Quality as central to how students assess the value of LMS platforms, echoing the model refinement proposed by DeLone and McLean (2003). Interestingly, while Service Quality did not emerge as a significant predictor of perceived usefulness or ease of use, this does not necessarily diminish its theoretical value. Instead, it suggests that for more digitally fluent users—like computer science students—service support may need to evolve beyond traditional helpdesks into more personalized, proactive, or self-guided formats. This invites future research to re-examine how support mechanisms can be redefined for tech-savvy learners in digital learning ecosystems.

5.5.2 Practical Implications

- **For LMS developers**: The findings underscore the need to enhance the LMS in terms of system stability, usability, and accessibility. Students emphasized that being able to access the platform anytime and from any device, without delays or crashes, is essential for maintaining productivity. Developers should focus on improving platform speed, minimizing system errors during peak periods (such as exams), and ensuring compatibility across browsers and devices. A clean, user-friendly interface that simplifies navigation and reduces cognitive load is especially important for tech-savvy users. Incorporating features such as progress tracking, dashboard summaries, and mobile optimization can also elevate the overall user experience.

- **For university educators**: The strong influence of Information Quality suggests that students place high value on clear, organized, and relevant content. Educators should ensure that materials are not only up-to-date and well-structured but also aligned with course outcomes. Based on student responses, content delivery should be more engaging—through the use of recorded lectures, interactive modules, and discussion forums. Training in digital pedagogy and instructional design can help lecturers create content that supports independent learning while remaining structured and easy to follow. Encouraging active participation, for instance through coding tasks or collaborative assignments, can help boost satisfaction and engagement.

- **For university administrators**: Although Service Quality was not a strong statistical predictor, students still noted various challenges related to support—such as slow system response, lack of real-time help, and confusing UI after updates. To better support this user group, institutions should modernize support services. This could include implementing AI-based help tools, step-by-step guides, and on-demand tutorials that match the self-reliant learning style of computer science students. Additionally, providing coding integration tools and practice environments directly into the platform. These tools would allow students to write, test, and debug code without needing to switch to external applications, improving both learning efficiency and user experience. IT support teams should also focus on system monitoring and proactive error handling rather than just waiting for issue reports.
- **For policy makers and IT support teams**: Institutional policies should prioritize investment in LMS infrastructure, content curation standards, and periodic platform evaluation. Instead of viewing support as just technical assistance, it should be reimagined as part of the learning ecosystem by supporting both system use and academic development. Blended learning strategies must reflect the needs of digital-native learners by ensuring that systems are reliable, content is engaging, and the platform supports real academic growth.

This research aimed to identify key LMS factors that influence student engagement and academic performance, and to propose a structured evaluation framework based on user perceptions. The practical implications discussed align closely with the project outcomes outlined in Chapter 1, particularly in identifying critical LMS components and offering an empirically grounded model for evaluating LMS effectiveness in higher education settings.

5.6 Conclusion

This chapter presented a comprehensive discussion of the study's findings in relation to the research framework and objectives. The results confirmed that Perceived Usefulness is the strongest predictor of Student Satisfaction and Engagement, which in turn has a significant impact on Academic Performance. System Quality and Information Quality were identified as the key drivers of these perceptions, while Service Quality showed a limited role in influencing outcomes. These findings reinforce the applicability of the Technology Acceptance Model (TAM) and the Information Systems Success Model (ISSM) in evaluating LMS effectiveness. Overall, the study emphasizes the importance of well-structured content and reliable system performance in fostering student engagement and academic success in blended learning environments.

CHAPTER 6: CONCLUSION AND FUTURE WORKS

6.1 Introduction

This final chapter concludes the research by summarizing the key findings and academic contributions. It also outlines the study's limitations and presents recommendations for future research, focusing on enhancing Learning Management System (LMS) implementation and blended learning effectiveness in computer science education.

6.2 Summary of the Study

This study examined the adoption of blended learning (BL) in computer science education at Universiti Malaysia Sarawak (UNIMAS) through the integration of the TAM and the IS Success Model. The study investigated how System Quality, Information Quality, and Service Quality influence Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), and how these perceptions subsequently affect Student Satisfaction, Engagement, and Academic Performance.

Using a quantitative design, data were collected from 191 computer science undergraduates through a structured questionnaire. Analysis using SPSS revealed that System Quality and Information Quality significantly influenced both PU and PEOU. However, Service Quality had no significant direct effect on either construct. In addition, PU significantly impacted Student Satisfaction and Engagement, which in turn strongly predicted Academic Performance. PEOU, while correlated with satisfaction and engagement, did not show a significant direct effect in the regression model. These results support six out of the nine proposed hypotheses and provide empirical validation for a refined Blended Learning Adoption Model tailored for technical education.

6.3 Contributions of the Study

This research contributes to both theory and practice in several ways:

- **Theoretical Contribution**: By combining TAM and ISSM, the study presents a validated Blended Learning Adoption Model for Computer Science, demonstrating how technology quality dimensions influence academic outcomes through perception and engagement.

- **Empirical Evidence**: The study confirms that PU is more influential than PEOU in technical fields where users are more digitally literate, aligning with findings in previous technology acceptance studies.
- **Practical Value**: The findings offer actionable insights for LMS developers and educators to focus efforts on improving system reliability, content quality, and user engagement mechanisms—rather than overemphasizing service response.
- **Supportive Qualitative Insight**: Although the study is quantitative, responses to open-ended questions provided supplementary context, particularly regarding challenges faced with LMS use and suggestions for improvement.

6.4 Limitations of the Study

While this study provides meaningful insights, several limitations should be acknowledged:

- **Sample specificity and generalizability constraints**: The sample was limited to computer science students at a single university (UNIMAS), which may restrict the generalizability of the findings to other disciplines or institutions. Additionally, institutional-specific LMS configurations and teaching practices may not reflect other educational contexts.
- **Temporal limitations of cross-sectional design**: The research was cross-sectional, capturing student perceptions at one point in time. This limits the ability to observe how attitudes evolve over a semester or academic year.
- Self**-report bias and measurement validity concerns**: The study relied on self-reported data, which may be subject to bias. Factors such as academic stress, recent LMS experiences, or social desirability may affect students' responses, and self-assessed academic performance may not fully reflect actual learning outcomes.

6.5 Recommendations for Future Research

To enhance and build upon the findings of this study, future research could consider the following directions:

- **Longitudinal studies**: Conduct multi-semester investigations to track how student perceptions and LMS usage patterns change over time. This would allow researchers to examine the relationship between evolving user competence and satisfaction levels and establish stronger causal relationships between LMS quality factors and academic outcomes.
- **Mixed methods approach**: Integrate qualitative components such as focus groups, in-depth interviews, and observational studies to uncover underlying user motivations, identify specific pain points in LMS interaction, and explore contextual factors that quantitative measures cannot capture.
- **Cross-disciplinary and multi-institutional validation**: Expand sampling to include students from diverse academic backgrounds (humanities, sciences, business) across multiple universities with varying technological infrastructures. This would help establish the generalizability of findings and reveal discipline-specific usage patterns and learning preferences.

6.6 Conclusion

In conclusion, this study confirmed that in the context of blended learning for computer science students, System Quality and Information Quality are foundational in shaping how students perceive and engage with LMS platforms. Perceived Usefulness emerged as the strongest mediator between system quality and academic performance, while Service Quality showed limited direct influence. These insights informed the development of a refined theoretical framework and offer practical guidance for improving LMS design and blended learning implementation. As higher education increasingly integrates digital platforms, the findings provide timely, evidence-based direction for enhancing learner-centered teaching and learning environments.

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APPENDIX A

Table A1 Questionnaire Instrument

Variables	Items	Sources
System Quality	The LMS is easy to navigate and use. The LMS is reliable and performs without frequent errors. The LMS allows me to engage actively in classes. I can access LMS anytime and from anywhere. The LMS provides a user-friendly interface for completing course-related tasks.	Atukunda et al. (2024) and Mohammadi (2015).
Information Quality	The content provided through the LMS is accurate and helpful. The course materials on the LMS are relevant to my academic needs. The information on the LMS is organized and easy to understand. The LMS provides sufficient detail in course content to support my learning. The materials on the LMS align with the objectives of my computer science courses.	Atukunda et al. (2024) and Mohammadi (2015).
Service Quality	I receive prompt assistance when I face technical issues with the LMS. The technical support staff are knowledgeable and helpful. The instructional support provided (e.g., tutorials or FAQs) meets my needs. I feel supported when using the LMS for blended learning. The availability of support services improves my learning experience.	Atukunda et al. (2024) and Mohammadi (2015).
Perceived Usefulness (PU)	The LMS improves my understanding of the course content. The LMS improves my understanding of the course content.	

	Using LMS enhances my academic performance. I find the LMS useful for managing my time and learning tasks.	Anthony Jnr (2024) and Laifa et al. (2023).
Perceived Ease of Use (PEOU)	Learning how to use the LMS was straightforward. The LMS requires minimal effort to accomplish learning tasks. I can quickly find the resources I need on the LMS. The LMS interface is intuitive and simple to use.	Anthony Jnr (2024) and Laifa et al. (2023).
Engagement and Satisfaction	The LMS keeps me engaged with my coursework. I feel motivated to participate in blended learning activities using the LMS. The LMS facilitates collaboration with peers (e.g., group projects). The LMS meets my expectations for a productive learning environment. Overall, I am satisfied with my blended learning experience using the LMS.	Mohammadi (2015) and Laifa et al. (2023).
Academic Performance	Blended learning has positively impacted my grades in computer science courses. I feel more confident in applying theoretical knowledge through LMS resources. The LMS has improved my practical skills (e.g., problem-solving). My ability to complete assignments has improved with blended learning. The LMS contributes to my academic growth and overall performance.	Anthony Jnr (2024) and Laifa et al. (2023)

Open-Ended Questions

In addition to the structured items, participants were invited to respond to the following open-ended questions to provide further insights into their experiences with the LMS:

1. What aspects of the LMS do you find most helpful for your learning?
2. What challenges have you encountered while using the LMS for blended learning?
3. How can the LMS be improved to better support your computer science education?

These questions were included to gather students' perspectives in their own words and support the interpretation of quantitative findings, particularly in relation to perceived challenges and potential areas for system enhancement.

APPENDIX B

Model 1: Perceived Usefulness

Table B1 Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.664[a]	.441	.432	.50421	1.614

a. Predictors: (Constant), Service_Quality, System_Quality, Information_Quality

b. Dependent Variable: Perceived_Usefulness

Table B2 ANOVA Table

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.519	3	12.506	49.193	<.001[b]
	Residual	47.541	187	.254		
	Total	85.060	190			

a. Dependent Variable: Perceived_Usefulness

b. Predictors: (Constant), Service_Quality, System_Quality, Information_Quality

Model 2: Perceived Ease of Use

Table B3 Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.686[a]	.470	.462	.46946	1.686

a. Predictors: (Constant), Service_Quality, System_Quality, Information_Quality

b. Dependent Variable: Perceived_Ease_of_Use

Table B4 ANOVA Table

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.555	3	12.185	55.287	<.001[b]
	Residual	41.214	187	.220		
	Total	77.769	190			

a. Dependent Variable: Perceived_Ease_of_Use

b. Predictors: (Constant), Service_Quality, System_Quality, Information_Quality

Model 3: Student Satisfaction and Engagement

Table B5 Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.690[a]	.476	.470	.47812	1.743

a. Predictors: (Constant), Perceived_Ease_of_Use, Perceived_Usefulness

b. Dependent Variable: Student_Satisfaction_Engagement

Table B6 ANOVA Table

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	39.021	2	19.511	85.347	<.001[b]
	Residual	42.977	188	.229		
	Total	81.998	190			

a. Dependent Variable: Student_Satisfaction_Engagement

b. Predictors: (Constant), Perceived_Ease_of_Use, Perceived_Usefulness

Model 4: Academic Performance

Table B7 Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.793[a]	.629	.627	.37322	1.967

a. Predictors: (Constant), Student_Satisfaction_Engagement

b. Dependent Variable: Academic_Performance

Table B8 ANOVA Table

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	44.543	1	44.543	319.786	<.001[b]
	Residual	26.326	189	.139		
	Total	70.870	190			

a. Dependent Variable: Academic_Performance

b. Predictors: (Constant), Student_Satisfaction_Engagement

APPENDIX C

Model 1: Perceived Usefulness

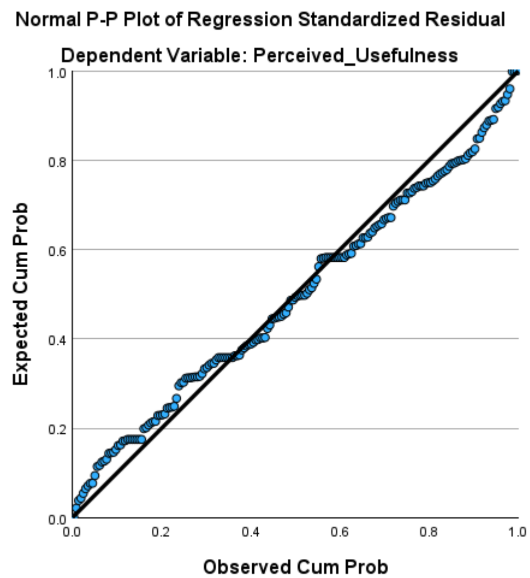

Figure C1: Normal P–P Plot

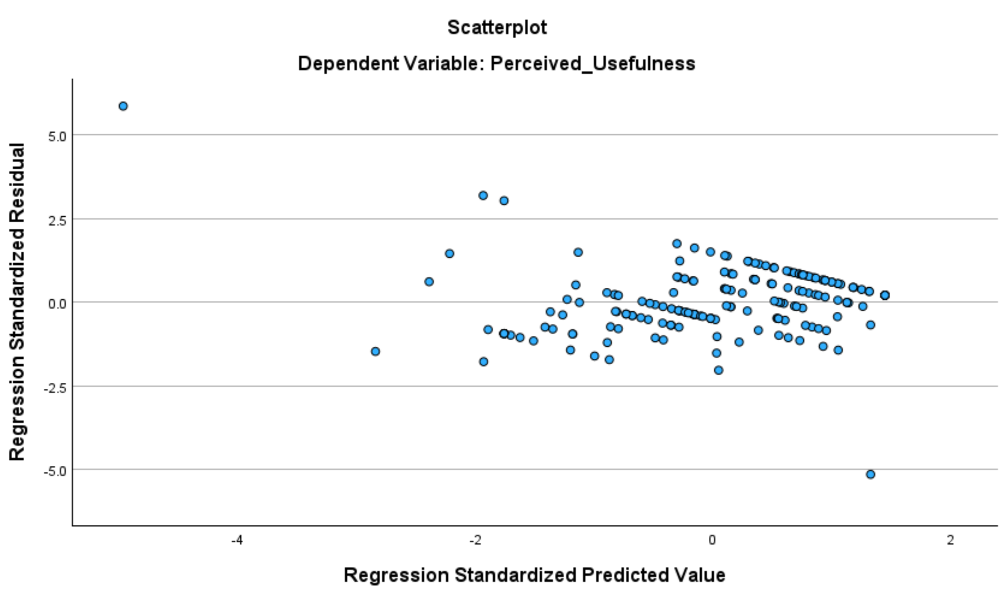

Figure C2: Residuals vs. Predicted Values

Model 2: Perceived Ease of Use

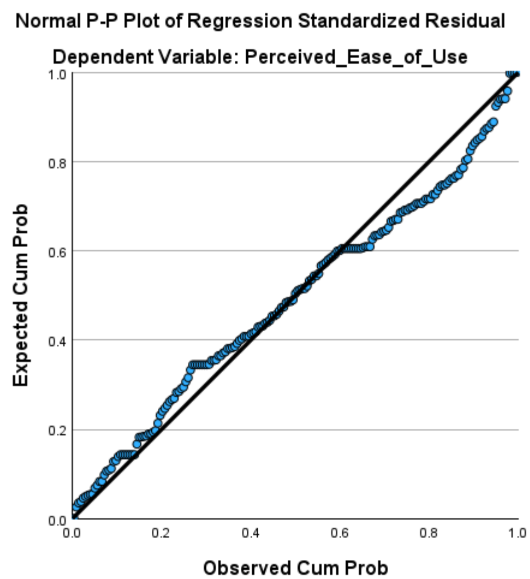

Figure C3: Normal P–P Plot

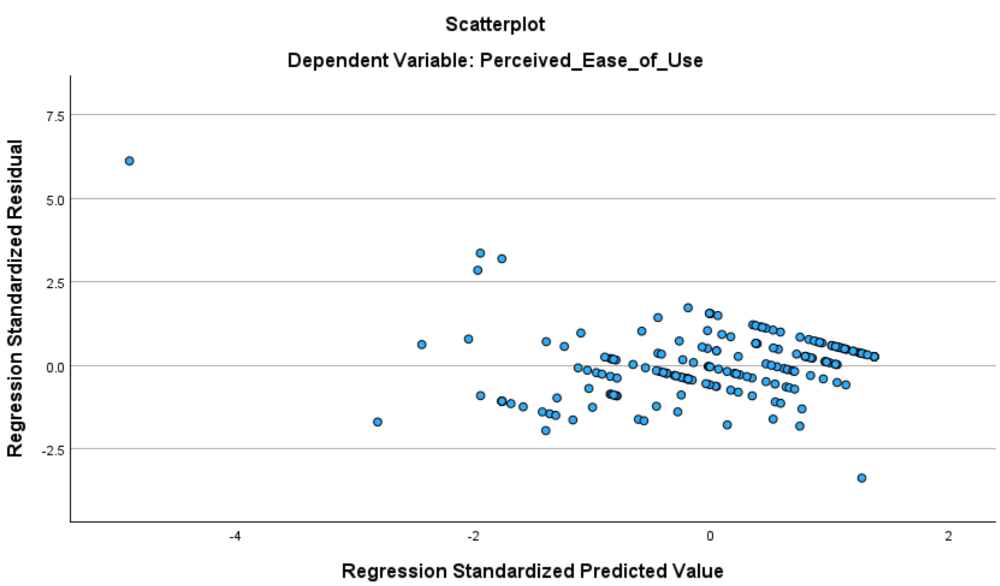

Figure C4: Residuals vs. Predicted Values

Model 3: Student Satisfaction and Engagement

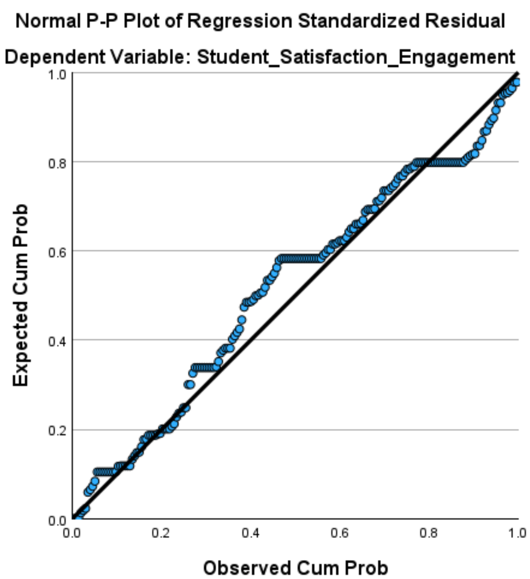

Figure C5: Normal P–P Plot

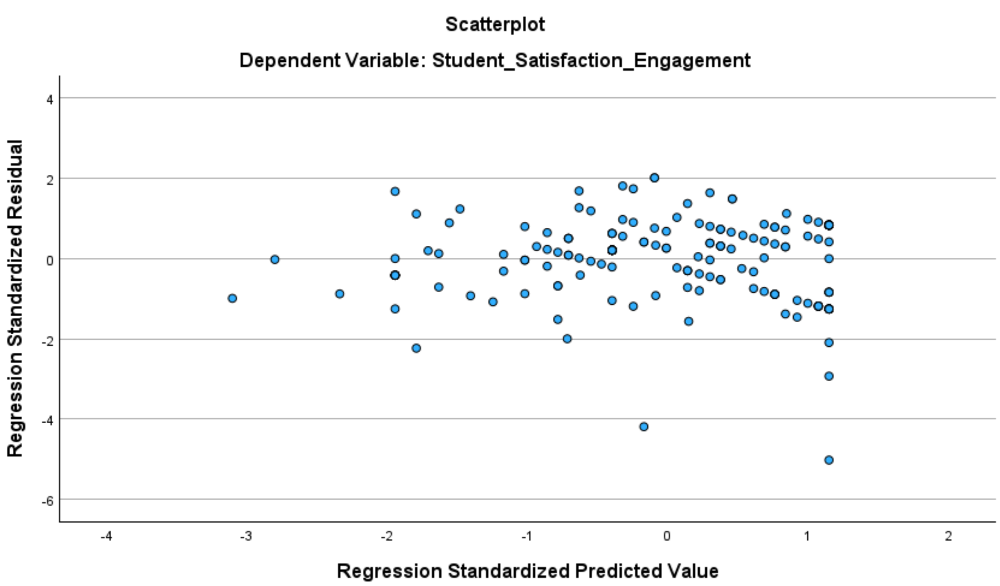

Figure C6: Residuals vs. Predicted Values

Model 4: Academic Performance

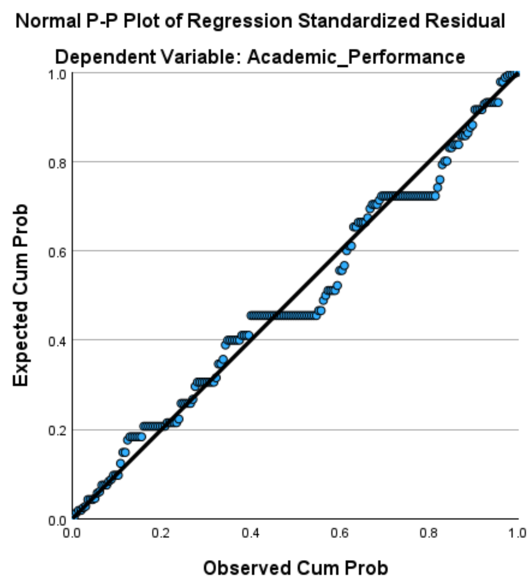

Figure C7: Normal P–P Plot

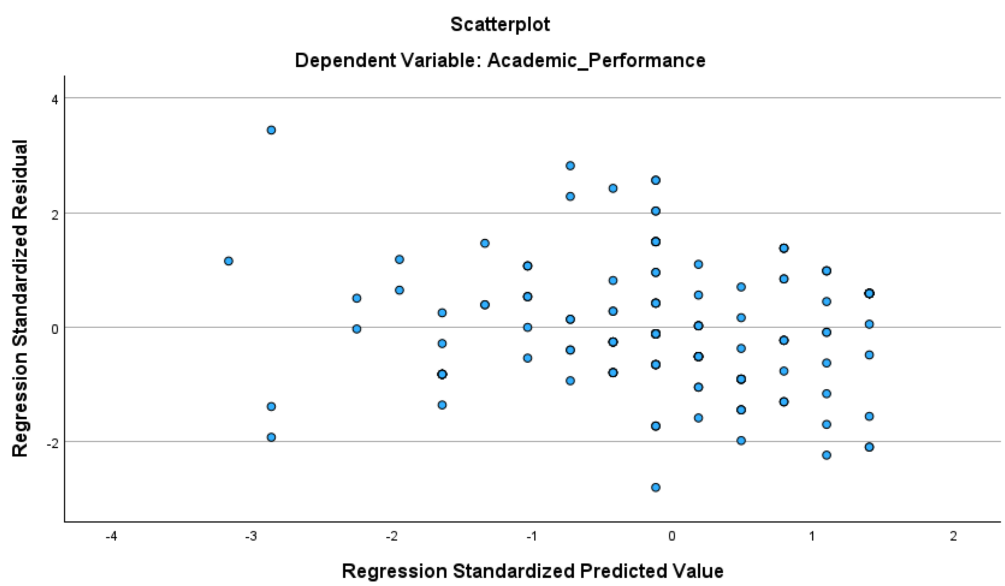

Figure C8: Residuals vs. Predicted Values