

Higher Education: The Efficacy of Online Learning Towards the Effectiveness of Content Comprehension

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Abstract: *Online learning, which is a type of learning that happens through websites, is relatively new. It looked at how contingent factors affected the correlation between four variables and the efficacy of online learning towards the effectiveness of content comprehension. Nowadays, implementing online learning is a crucial stage in university. The main goal of this study is to assess how effective online learning is for the higher education level in Malaysia. Additionally, this study used a poll of students as participants to examine the crucial elements influencing the efficacy of online learning towards the effectiveness of content comprehension. 154 undergraduate students from a variety of higher education institutions participated in the survey. The effectiveness of online learning is correlated with a number of aspects, including students' satisfaction, usefulness and intention to use online learning. The result indicates that online learning is positively and significantly correlated with students' pleasure, and online learning efficacy is influenced by usefulness which encourages students' preference in this era.*

Keywords: Online learning, Effectiveness of content comprehension, Higher Education

1. Introduction

1.1 Background of the Study

The COVID-19 pandemic posed unprecedented challenges for higher education institutions worldwide, prompting a rapid shift to online learning. For instance, the University of Cambridge moved all teaching online for the 2020/2021 academic year to prevent virus transmission (Mentchen, 2021). Similarly, in Malaysia, the Movement Control Order (MCO) led the Ministry of Higher Education to mandate online teaching until December 2020 (Malaysian Ministry of Higher Education, 2020). By mid-2020, 85% of Malaysian universities had transitioned to online learning, supported by significant investments in digital infrastructure, allowing lessons and assessments to be conducted online swiftly (Chung et al., 2020).

Understanding the effectiveness of online learning, especially regarding content comprehension, is crucial. Content comprehension is defined as students' ability to understand, retain, and apply the material they are taught, which is a key indicator of educational success (Patra et al., 2022). Understanding involves grasping concepts and information deeply (Kamagi, 2023), retention refers to remembering and recalling information over time

(Namaziandost, Sawalmeh, & Soltanabadi, 2020), and application is using knowledge in practical, real-world situations, demonstrating mastery of the subject matter.

1.2 Research Problem

This research investigates how various factors influence content comprehension in online learning, using constructivist theory as the framework. The key factors include the efficacy of online learning, student engagement, instructor support, and the interactivity of online platforms. These will be explored in detail in Chapter 2.

1.2.1 Efficacy of Online Learning

Efficacy in online learning refers to the success of digital education programs in achieving learning outcomes (Hongsuchon et al., 2022). Online education can engage students through virtual field trips, video-conferenced guest lectures, and interactive experiences with peers (Haleem et al., 2022). Paudel (2020) found that 46.2% of students considered online courses beneficial due to convenience and personalized learning, while fewer saw financial benefits or opportunities to meet interesting people. This underscores the importance of convenience and personalized learning in online education. The challenge lies in ensuring these digital methods effectively facilitate meaningful learning experiences.

1.2.2 Student Engagement

Student engagement, defined as active involvement in educational activities and commitment to learning goals, is crucial in online environments (Chiu, 2021). Engaged students are more motivated and achieve better academic results (Alqurashi, 2022). However, the shift to online learning during COVID-19 posed challenges to engagement, with students reporting decreased interaction with peers and instructors (Hollister et al., 2022). This research aims to understand how student engagement affects content comprehension in online learning, seeking strategies to enhance engagement and improve academic outcomes.

1.2.3 Instructor Support

Instructor support involves engaging in teaching practices that promote interactive learning, including providing feedback, facilitating discussions, and connecting students to resources (Kwan et al., 2021). Effective instructor support mitigates online learning challenges, such as isolation and lack of motivation (Garrison, 2022). Hollister et al. (2022) found that students' interaction with instructors decreased during online learning, affecting their academic experience. This study examines how instructor support influences content comprehension, aiming to identify best practices for enhancing support in online education.

1.2.4 Interactivity in Online Platforms

Interactivity in online platforms, defined as responsive content that fosters active learning, is critical for effective online education (Koblyakov, 2024). Studies, such as Yan et al. (2022), highlight the need for more interactive online sessions, despite institutional and technical barriers. This research includes interactivity as a key variable, exploring how it influences student engagement and learning outcomes in a diverse Malaysian university setting.

1.3 Research Objectives

The objectives of this study are:

- 1) To investigate how the efficacy of online learning influences content comprehension.
- 2) To explore the impact of interactivity on online platforms on student engagement and content comprehension.

- 3) To examine how student engagement affects the effectiveness of online learning in terms of content comprehension.
- 4) To assess the role of instructor support in the efficacy of online learning.

1.4 Research Questions

This study seeks to answer the following research questions:

- 1) How does the efficacy of online learning influence content comprehension?
- 2) What is the impact of interactivity in online platforms on student engagement and content comprehension?
- 3) How does student engagement affect the effectiveness of online learning in terms of content comprehension?
- 4) What role does instructor support play in the efficacy of online learning?

1.5 Significance of the Study

This study explores critical factors influencing the effectiveness of online learning, particularly regarding content comprehension among university students in Malaysia. As online education grows, understanding the impact of efficacy, engagement, instructor support, and interactivity on learning outcomes is pivotal. This research addresses gaps in the literature by focusing on a diverse student population and examining these factors through constructivist theory. Findings will inform educational institutions and policymakers on enhancing online education strategies to optimize student success.

2. Literature Review

2.1 Underpinning Theory

Jean Piaget's Constructivist Learning Theory provides a crucial framework for understanding the efficacy of online learning in enhancing content comprehension among higher education students. This theory highlights the importance of individual interpretation and understanding of materials, making it highly relevant in the context of online learning environments where content comprehension is a foundational competency (Le et al., 2024; Amna et al., 2021).

Piaget's theory emphasizes that student engagement and instructor support are vital for increasing the efficacy of online learning (Sharma, 2020; Pribadi et al., 2022; Raturi, 2023). Additionally, it underscores the development of student autonomy, which positively influences course structure and targeted knowledge and skills. This allows students to apply what they are learning, reflect on their progress, and set goals (Abuhassna et al., 2022; Azhiimah et al., 2021). While constructivism focuses on active, experiential learning where knowledge is constructed through interaction with the environment, it lacks emphasis on the interactivity of online platforms, which is a crucial element for maximizing learning opportunities in a constructivist classroom (Rosenblit & Gros, 2023).

Piaget's theory encourages active techniques for knowledge creation, reflection, and discussion, fostering changing understandings (Sharma, 2020; Barak & Green, 2021). Research consistently shows strong correlations between student engagement (attention, active participation, time on task) and student achievement across various levels and subjects. Effective online learning platforms incorporate interactive and engaging activities, significantly enhancing students' learning experiences and outcomes (Pribadi, 2022).

Instructor support is critical in online learning environments as per Piaget's theory, impacting the efficacy of online learning. Teachers should create interactive environments that develop

students' cognitive abilities and knowledge, acting as mediators rather than traditional information providers (Sharma, 2020; Erbil, 2020). By promoting multiple perspectives and cognitive mapping, instructors facilitate deeper comprehension and cognitive development, essential for effective online learning (Sharma, 2020; Andrade & Brookhard, 2020).

Piaget's theory also highlights the role of student autonomy which is a learning driven by self-initiative without external pressure. This fosters independent learning attitudes and superior outcomes (Azhiimah et al., 2021; Muhammad, 2020). In online learning, autonomy allows learners to control their educational experiences, leading to increased motivation, deeper engagement, and personalized learning (Dalores et al., 2022; Abuhassna et al., 2022). However, purely autonomous learning may not ensure effective content comprehension, which often requires structured guidance, interactive engagement, and immediate feedback.

Piaget's theory underscores interactive environments where students engage with content, and instructors facilitate cognitive development (Amna et al., 2021). Autonomy alone may lack the interactive elements essential for deeper understanding. The interactivity of online platforms, identified as a research gap, addresses the need for active engagement, immediate feedback, and dynamic learning environments (Rosenblit & Gros, 2023). Interactive elements like discussions, quizzes, and collaborative projects promote active participation and deeper comprehension, aligning with Piaget's emphasis on learning through active exploration and social interaction (Mutrik, 2023).

2.2 Research Framework

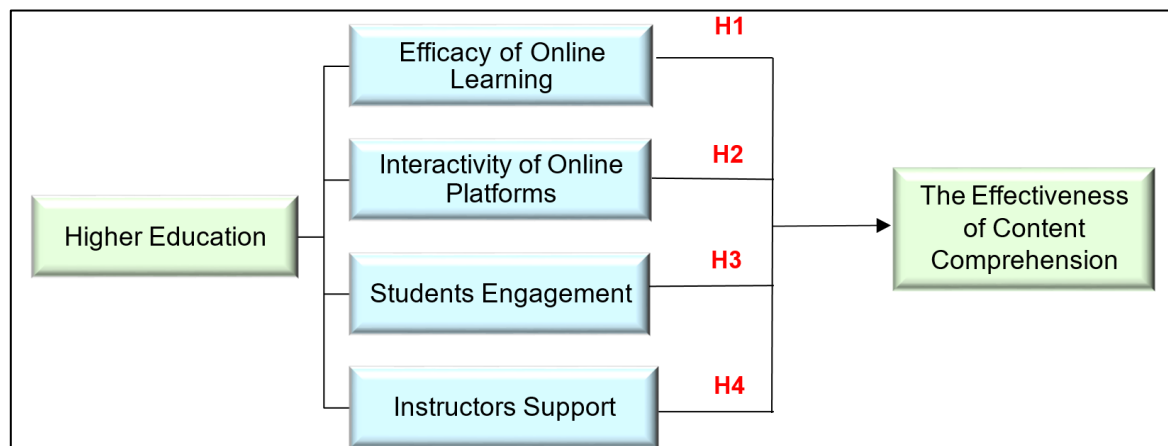


Diagram 1: Research Framework

2.3 The Relationship Between the Efficacy of Online Learning, the Interactivity of Online Learning, Student Engagement, and Instructor Support

2.3.1 The Relationship Between the Efficacy of Online Learning and the Effectiveness of Content Comprehension

Research indicates that various aspects of online learning significantly enhance content comprehension. A study by Muthuprasa et al. (2021) reveals that the flexibility and accessibility of online learning systems allow students to access course materials anytime and anywhere, leading to improved comprehension and retention. Educational resources such as interactive simulations and videos cater to different learning styles, simplifying complex ideas (Hodges et al., 2020). Adaptive learning technologies personalize learning paths based on student performance, ensuring targeted assistance for difficult subjects (Zhang et al., 2020). Engaging and collaborative tools facilitate communication and idea exchange between students

and teachers, enhancing understanding (Mishra et al., 2020). Furthermore, self-directed learning enables students to learn at their own pace, ensuring complete comprehension before progressing (Kim, 2020).

2.3.2 The Relationship Between Interactivity of Online Platforms and the Effectiveness of Content Comprehension

Interactivity on online platforms significantly impacts content comprehension by managing cognitive load and enhancing learning experiences. Interactive platforms divide information into manageable portions, aiding better understanding (Jongyun et al., 2020). Researchers Afify (2020) and Haryani et al. (2021) highlight key factors such as enhanced visualization, engaging assessment, and peer interaction. Multimedia components like videos and animations improve visualization of abstract topics, boosting comprehension. Interactive assessments, including adaptive quizzes and branching scenarios, dynamically engage learners, reinforcing lessons. Peer interaction through discussion boards and group projects fosters a community learning environment, allowing students to clarify doubts and deepen understanding by leveraging collective knowledge.

2.3.3 The Relationship Between Student Engagement and the Effectiveness of Content Comprehension

Student engagement in online learning directly correlates with content comprehension. Sharma (2020) emphasizes that cloud-supported collaborative technologies facilitate resource sharing and discussions, enhancing subject matter comprehension. Reflective thinking tasks, such as group discussions and self-evaluation assignments, promote deeper understanding and successful knowledge development. Increased self-efficacy and motivation, linked to higher engagement levels, enable better comprehension and retention of material (Pribadi, 2022). Additionally, educator presence in virtual learning environments, providing prompt feedback, insightful remarks, and consistent interaction, supports sustained student interest and improves content comprehension (Erbil, 2020).

2.3.4 The Relationship Between Instructor Support and the Effectiveness of Content Comprehension

Instructor support plays a critical role in content comprehension in online learning. Van Mart et al. (2020) identify key factors such as feedback and clear communication, well-organized course design, and the use of technological tools. Clear, timely feedback from instructors enhances curriculum comprehension and ease of using online resources, leading to better understanding. Well-structured courses with defined objectives and organized materials improve content retention. Effective use of technology, like learning management systems and educational apps, facilitates better organization and accessibility of materials. Nguyen et al. (2021) emphasize regular evaluation and modification of teaching strategies based on student understanding, as well as promoting student engagement through collaborative projects and discussions, which help process and remember information more efficiently, promoting deeper engagement with content.

2.4 Statement of Hypothesis

H1: The efficacy of online learning has a significant positive effect on content comprehension.

H2: Interactivity of the online platforms positively influences content comprehension.

H3: Student engagement positively influences the effectiveness of content comprehension.

H4: Effective instructors support a significant positive effect on student content comprehension.

3. Methodologies

This research investigates the efficacy of online learning on content comprehension among higher education students in Malaysia. To achieve this, the study adopts a positivist research philosophy, which emphasizes the use of empirical and quantifiable data obtained through structured scientific processes. Positivism ensures that the findings are objective, reliable, and replicable, minimizing researcher bias and supporting generalizable conclusions. A quantitative approach is chosen to collect numerical data using structured surveys, enabling the study to identify patterns, relationships, and potential causal links between variables.

The research employs a descriptive and cross-sectional design to analyze the current conditions of online learning and its influence on content comprehension. The descriptive design helps explain "what" is occurring in online learning environments, while the cross-sectional approach allows data collection at a single point in time, making it suitable for understanding the present state of the phenomenon under investigation. Data is collected through surveys hosted on Google Forms, a platform that allows for easy distribution and accessibility. Surveys are disseminated via university mailing lists, social media platforms, and student forums to ensure broad and unbiased participation, increasing the representativeness of the sample.

The study adopts a stratified random sampling method, ensuring that the population is divided into subgroups (or strata) based on specific characteristics, such as fields of study (e.g., science, arts, engineering), before randomly selecting participants from each group. This method minimizes sampling bias and ensures that the findings accurately represent the diverse student population enrolled in online programs across Malaysia. The sample size of 154 respondents is determined using statistical power analysis, which ensures the sample is large enough to detect significant relationships and produce reliable results.

The survey instrument comprises closed-ended questions, including multiple-choice and Likert-scale items, organized into sections that address demographics, online learning variables, and content comprehension. These questions are adapted from prior research to fit the study's context and are designed to measure independent variables such as the effectiveness of online learning, student engagement, instructor support, and platform interactivity. Before full deployment, the survey undergoes pre-testing with a small group of students to ensure its clarity, accuracy, and reliability.

Data analysis is conducted using the Statistical Package for Social Sciences (SPSS). Descriptive statistics, such as measures of central tendency (mean, median, mode) and dispersion (standard deviation, variance), provide a summary of participant responses. Inferential statistical techniques, including regression and correlation analyses, are applied to explore the relationships between independent variables and the dependent variable, content comprehension. Hypothesis testing is also conducted to determine the significance of these relationships, offering robust insights into how online learning impacts students' understanding of content. This comprehensive methodology is designed to achieve the research objectives by providing a detailed and generalizable evaluation of the effectiveness of online learning on content comprehension, thereby contributing valuable findings to the field of education research.

4. Findings and Results

The following findings are based on the research accomplished during the projects, a survey of the efficacy of online learning towards the effectiveness of content comprehension in higher education. Four methods of analysis were used to analyse which are demographic analysis, normality analysis, reliability analysis, and correlation analysis.

4.1 Normality Analysis

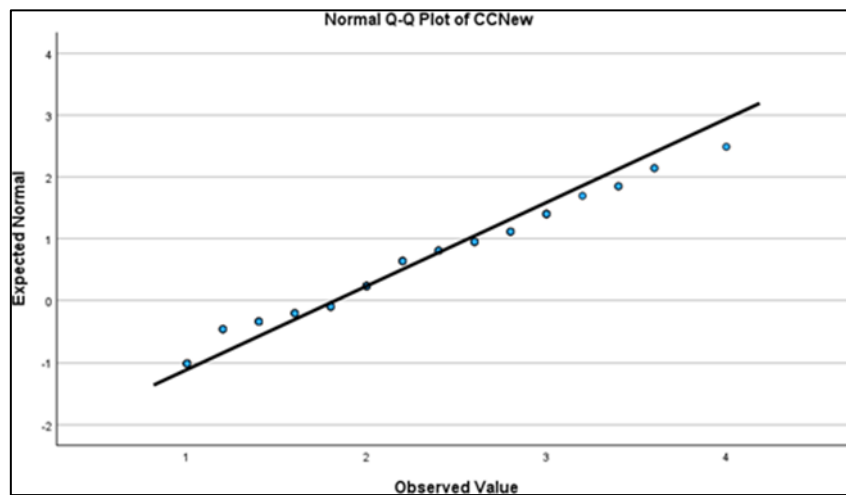


Figure 1: Normality on Analysis on Effectiveness of Content Comprehension

Based on Figure 1, results show that the data points fall closely on the diagonal line. This is the outcome that proves that the data sample has been normally distributed.

4.2 Reliability Analysis

Table 1: Reliability Analysis

Reliability Analysis	Cronbach's Alpha	No. of Items
Effectiveness of Content Comprehension	0.924	5
Efficacy of Online Learning	0.910	5
Interactivity of Online Platform	0.915	5
Student Engagement	0.926	5
Instructor Support	0.957	5

Based on the reliability analysis, it shows that the Cronbach's Alpha value for dependent and independent variables of effectiveness of content comprehension, efficacy of online learning, interactivity of online platform, student engagement and instructor support are above 0.7. Therefore, the items are consistent enough to show that the measurement is accurate and have good internal consistency.

4.3 Correlation Analysis

**Table 2: Correlation Analysis
Correlations**

		CCNew	OLNew	IPNew	SENew	ISNew
CCNew	Pearson Correlation	1	0.708**	0.713**	0.688**	0.645**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	154	154	154	154	153
OLNew	Pearson Correlation	0.708**	1	0.819**	0.698**	0.637**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	154	154	154	154	153
IPNew	Pearson Correlation	0.713**	0.819**	1	0.784**	0.717**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	154	154	154	154	153
SENew	Pearson Correlation	0.688**	0.698**	0.784**	1	0.756**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	154	154	154	154	153
ISNew	Pearson Correlation	0.645**	0.637**	0.717**	0.756**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	153	153	153	153	153

Table 2 above shows results of correlation analysis. This analysis was used to show the significant relationship between dependent and independent variables. When the significant value is 0.05 and below, it shows that the variables are statistically significant. Based on the results above, there are significant relationships between dependent variables and independent variables hence the significant value is 0.001.

5. Discussion

The effectiveness of content comprehension is essential for students to understand and excel in academically. The effectiveness of online learning compared to traditional face-to-face instruction, found that students in online conditions performed modestly better (Zulaikha Mohd Basar et., al (2021)). This study explored the relationship between the efficacy of online learning(H1) and the effectiveness of content comprehension in higher education. The efficacy of online learning is reflected in increasing enrolment rates and positive student outcomes. To have the efficacy of online learning, the student must be equipped with the knowledge and skills of online learning to achieve desired content comprehension (Prabowo et., al (2022)). Based on the data collected from 154 respondents, 139 of them have experience with online learning. Furthermore, 109 of the respondents who answered yes to online learning experience are from private institutions. This could indicate that students from private institutions received more exposure of online learning in their studies. Apart from that, 39% of respondents answered agree on the question of whether they engaged in various online content. Plus, the percentage of the respondents who strongly agree that they engaged in various online content is 48.7%. is the highest for this question.

Our theory hypothesis regarding the interactivity of online platforms(H2) was found to be substantially important in content comprehension. These findings are affected by the content delivery method. It can be shown from interactive elements which motivate students to engage in learning hence increasing content comprehension. Interactive elements such as simulations and interactive diagrams allow learners to engage with content actively, facilitating better

comprehension and retention (Smiderle et al., 2020) Therefore, university students who are highly engaged in the interactivity of online learning most of them are engaged in learning management systems that allow easy assessment, real-time feedback, and enhanced content comprehension.

The next major finding of this study is student engagement (H3). It is a crucial element in content comprehension. The respondents actively participate in online learning so that they can easily comprehend the content. Student engagement in higher education, including online learning environments, is important in content comprehension. Engaged students are more likely to participate actively, interact with the material, and apply what they have learned, which enhances their understanding and retention of content (Sathe, Krishwasamy, Fun, & Thivaya, 2023). 70 respondents agree that they actively participate in online discussions, while 52 of respondents strongly agree on that. With virtual reality tools, the respondents also feel motivated to engage in online learning that enhances their content comprehension.

The last finding is instructor support (H4). The impact of instructor immediacy behaviors, such as timely feedback and personal interaction, on student engagement and comprehension in online courses is significant (Yuan, 2024). A total of 66 respondents agree that the support of the instructor helps them to understand the course material better. Plus, the percentage of the respondents who strongly agree that the support of the instructor helps them to understand the course material better is 39%. Learner-instructor interactions, such as timely feedback and personalized communication, positively influence students' perceived learning outcomes and comprehension (Seo, Tang, Roll, Fels, & Yoon, 2021). Most of the respondents said that they get instructor support by providing timely and constructive feedback on assignment in their online learning journey significantly improve their content comprehension.

6. Conclusion

This research addresses a significant gap in the existing literature by focusing on the Malaysian context, characterized by its diverse multicultural population. By exploring the interactions among these variables in Malaysia's diverse cultural context, this research provides a comprehensive understanding of how online learning can be tailored to meet the needs of a heterogeneous student body. These findings emphasize the need for well-designed, interactive, and supportive online learning frameworks to enhance student comprehension and overall educational outcomes, fulfilling a critical gap by providing valuable insights into the Malaysian multicultural context and contributing to the global discourse on effective online education practices.

The study investigated the relationship between the efficacy of online learning and content comprehension in higher education, revealing key insights into several influencing factors. First and foremost, the efficacy of online learning is essential for achieving effective content comprehension (Prabowo et al. (2022)), The analysis indicates that students from private institutions may have more exposure to online learning, potentially leading to better familiarity and competence in navigating online educational platforms. A significant portion of respondents indicated engagement with various online content, with many strongly agreeing that they were highly engaged. This high level of engagement underscores the potential effectiveness of online learning environments in fostering student interaction and comprehension. Next, the research further shows that interactivity within online platforms plays a significant role in enhancing content comprehension, as supported by Smiderle et al. (2020). The study's second hypothesis focuses on the role of interactivity in online platforms,

finding it crucial for content comprehension. Interactive elements like simulations and interactive diagrams are highlighted as key tools that actively engage students, leading to better understanding and retention of material. These elements are vital as they transform passive learning into an active experience, promoting deeper engagement and comprehension.

Additionally, the importance of student engagement in content comprehension is emphasized by Sathe et al. (2023), with active participation in online discussions and the use of virtual reality tools contributing to better comprehension. The findings of the study prove that the active participation in online discussions enhances their comprehension. The use of virtual reality tools further motivates students, indicating that technologically advanced interactive tools play a significant role in sustaining student interest and improving learning outcomes. Engaged students are more likely to interact with the material, participate in discussions, and apply learned concepts, which enhances their understanding and retention of content. Instructor support, as discussed by Yuan (2024) and Seo et al. (2021), also proves to be a crucial factor, with timely feedback and personalized interaction significantly enhancing students' understanding of course material. The study finds that a considerable number of respondents agreed or strongly agreed that instructor support helps them understand course material better. Timely feedback and personalized communication from instructors significantly impact students' perceived learning outcomes and comprehension. The importance of learner-instructor interactions is emphasized, as these interactions provide the necessary guidance and support to navigate online learning effectively. This research fills a significant gap in the literature by focusing on Malaysia's diverse multicultural context. By exploring these variables within this unique setting, the study offers comprehensive insights into tailoring online learning to meet the needs of a heterogeneous student body. The findings stress the importance of well-designed, interactive, and supportive online learning frameworks to enhance student comprehension and overall educational outcomes.

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