

Students' Perceptions of Online Learning and Their Impact on Academic Engagement

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ABSTRACT

This paper investigated student perceptions of online learning at Universiti Teknologi MARA (UiTM) Puncak Perdana and evaluated its subsequent impact on their academic engagement. The study systematically examined four core dimensions of digital pedagogy: learning flexibility, technological accessibility, educator support, and digital resources. Utilizing a quantitative research design, data were gathered from the target student population via a structured survey instrument. The empirical results indicate that these four foundational elements significantly correlate with students' perceptions and attitudes toward online learning. Furthermore, the findings reveal that positive student perceptions and attitudes exert a robust, positive influence on overall learning engagement. Ultimately, this research demonstrates that a well-structured digital learning ecosystem, coupled with targeted institutional support, serves as a primary catalyst for enhancing student motivation and participation within higher education frameworks.

Keywords: Online learning, learning flexibility, technological accessibility, digital resources, students' perceptions

INTRODUCTION

While online learning had already been transforming global higher education, the COVID-19 pandemic forced an unprecedented and rapid transition from traditional on-campus instruction to digital delivery models. This sudden shift universally disrupted students, educators, and institutions alike, fundamentally altering daily educational operations (Mailizar et al., 2020). Although the efficacy of this rapid digital adoption was more pronounced in technologically advanced nations (Basilaia & Kvavadze, 2020; Dietrich et al., 2020), online and hybrid modalities have since sustained widespread popularity among students. A key driver of this sustained adoption is the integration of synchronous and asynchronous components, which grants students autonomy over how and when they engage with course materials (Binnewies & Wang, 2019; Jordon et al., 2023). Consequently, this heightened flexibility empowers learners to customize their study schedules according to their personal routines and pedagogical preferences, ultimately facilitating a more personalized and accessible educational experience.

Furthermore, online learning provides asynchronous, ubiquitous access to educational materials, enabling students to engage with content independently of geographic or temporal constraints. This modality offers substantial flexibility, empowering learners to dictate the pace, timing, and methodology of their education to align with individual pedagogical needs. As noted by Heo et al. (2021), digital environments inherently foster resource acquisition skills, as students must utilize various technologies to locate and evaluate the online assets required for problem-solving. Through access to recorded lectures, digital readings, and

supplementary materials, students can effectively navigate a flexible, self-directed blended learning environment.

However, this paradigm shift introduces both distinct opportunities and challenges. Chief among these challenges is the student's ability to adapt to a highly technologized, self-directed ecosystem. To explore these dynamics, this study was conducted at Universiti Teknologi MARA (UiTM), Puncak Perdana Campus. In ensuring academic continuity, UiTM has extensively integrated online learning frameworks. Consequently, evaluating student perceptions and acceptance of these digital modalities is critical, as these factors serve as vital determinants of academic success and the overall efficacy of the online educational experience.

LITERATURE REVIEW

Overview of Online Learning

Online learning is a distinct educational modality wherein instructional delivery and student engagement occur entirely via digital platforms. This framework enables learners to leverage diverse digital resources to interact with course content, participate in collaborative discussions, and complete formal assessments asynchronously from any global location. Furthermore, when integrated with traditional face-to-face instruction, this digital transition establishes a hybrid environment. As Binnewies and Wang (2019) observe, such blended models grant students substantial autonomy, empowering them to determine the timing, pace, and manner of their engagement with various course components. On the other hand, Wan Mokhtar et. al. (2024) state that the extensive reliance on asynchronous digital communication introduces structural trade-offs, diminishing traditional face-to-face (F2F) collaborative skills.

As a transformative educational paradigm, online learning has emerged as a dominant instructional modality that shifts learning control from the institution to the student. By operating outside the constraints of the traditional classroom, this model grants learner's autonomy not only over their engagement with course content but also in how they interact with instructors and peers. This spatial and temporal flexibility allows students to establish personalized learning timelines, which fosters critical thinking, accommodates asynchronous peer feedback, and provides adequate time for cognitive reflection. Furthermore, the capacity to regulate the learning process has been associated with reduced academic anxiety compared to conventional face-to-face settings, thereby optimizing opportunities for personalized education. Additionally, Haleem et al. (2022) emphasizes that the inherent convenience of online education, driven by the widespread accessibility of digital technologies from domestic environments, further enhances its viability. They state that students can learn from "the convenience of their own homes" and discusses the increased accessibility and convenience provided by digital technologies.

This study combines various widely accepted theories to explore every angle of perception and attitude among UiTM students towards online learning. One of the main theories that is popular and often used in the research is the Technology Acceptance Model (TAM) proposed by Davis (1989), which states that perceived usefulness and perceived ease of use are also two main determinants of technology acceptance. Besides, this study is also based on Social Cognitive Theory (SCT) by Bandura which emphasizes several influences in social, observational learning and also self-efficacy in explaining each individual behavior. In online learning, students' confidence and motivation are important to engage themselves and it is greatly influenced by the interaction and support available from lecturers and peers around them. As a result, the variable that is educator support in the framework of this research is explicitly aligned with several principles of SCT guidance and encouragement (Azizan, Koo, & Samsudin, 2023).

METHODOLOGY

Data collection was executed using a digital questionnaire developed via Google Forms, which was distributed to respondents through institutional emails and WhatsApp broadcasting. The target population comprised active users of the Universiti Teknologi MARA (UiTM) Puncak Perdana Library, yielding a final sample size of 73 respondents. To ensure comprehension and minimize response bias, the instrument was

administered in a bilingual format (English and Malay). A quantitative research design was deployed, which was highly suited for examining the statistical relationships between student perceptions, attitudes, and engagement within online learning environments.

This approach facilitated the objective measurement of variables and enabled statistical data analysis to test the formulated hypotheses and answer the primary research questions. Furthermore, this design allowed for the identification of broader patterns and trends within the student responses, offering empirical insights capable of informing future institutional practices and policies at UiTM. Finally, the utilization of a quantitative framework permitted the adoption of established, validated instruments, thereby ensuring consistency and internal reliability across the sample.

ANALYSIS AND FINDINGS

Respondent Demographic Profile

This section presents the demographic profiles of the respondents who completed the survey instrument. These baseline data were collected to provide a comprehensive overview of the sample characteristics and to contextualize the interpretation of the primary research findings. The sample comprises students from Universiti Teknologi MARA (UiTM) Puncak Perdana who possess direct experience with online learning modalities.

To ensure the sample aligns accurately with the predefined target population, four key demographic variables were evaluated: gender, age, semester and also their experience in online learning. Descriptive statistics were employed to analyze these data, which are presented in tabular form below to facilitate a clear and structured synthesis of the participants' backgrounds

Gender of Respondent

Figure 1: Gender

Gender/Jantina					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female/Perempuan	35	47.9	47.9	47.9
	Male/Lelaki	38	52.1	52.1	100.0
	Total	73	100.0	100.0	

This study involved 73 respondents from various different backgrounds who participated in the research according to the data presented in this study. This sample showed that there were 38 male respondents who made up 52.1% percent of the study group results, while 35 female respondents made up 47.9% percent of the sample collected. This research study was able to achieve equal representation for both genders because as can be seen from the diagram above, there was only a slight percentage difference between the two genders which remained less than one percent.

The results of this study are also obtained from several research studies that always maintain their equality because some participant groups also contain equal proportions of male and female respondents. The data collected has been processed from research results which are more reliable because they reflect the overall group of participants who participated in this study.

Respondent Age

Figure 2: Age

Age/Umur		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 21	12	16.4	16.4	16.4
	22 - 25	44	60.3	60.3	76.7
	26 - 29	13	17.8	17.8	94.5
	30 and above/keatas	4	5.5	5.5	100.0
	Total	73	100.0	100.0	

In terms of age distribution, it also shows that most of the participants in this study are in the age group between 22 and 25 years old, which is 44 respondents, representing 60.3% of the total sample. The next age group is the most common and it includes respondents between the ages of 26 and 29 years and it makes up 17.8% of the sample.

The next group is in the age category between 18 and 21 years old, consisting of 12 participants with 16.4% of the sample. This study also found that only 5.5% of respondents were aged 30 and above. The age distribution in this study also shows that various categories of young adults, especially those in their early twenties, contributed a large portion of the research population. The findings in this study may also reveal some of the opinions and experiences of each of the younger participants.

Experience using Online Learning Platforms

Figure 3: Users' Experience

Do you have experience using online learning platforms? / Adakah anda mempunyai pengalaman menggunakan platform pembelajaran dalam talian?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Yes/Ya	73	100.0	100.0	100.0

Manifesting the baseline criteria for inclusion, 100% of the respondents (N = 73) confirmed active participation and prior experience in online learning platforms. This uniform affirmative response indicates that the entire sample possesses firsthand familiarity with digital learning environments.

Methodologically, this comprehensive user experience provides a robust foundation for the study, as it ensures that the subsequent data regarding student behaviors, perceptions, and attitudes are grounded in actual practice rather than theoretical assumptions. Consequently, the sample's preexisting knowledge enhances the validity of their evaluations, offering a reliable dataset for analyzing contemporary online pedagogical frameworks.

Reliability Test

Cronbach's Alpha Values

Scale: Independent Variable 1 (IV1) - Learning Flexibility

Figure 4: Cronbach's Alpha (IV1)

Reliability Statistics	
Cronbach's Alpha	N of Items
.895	4

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
LF1	11.99	7.708	.721	.882
LF2	12.03	7.583	.803	.853
LF3	11.96	7.373	.798	.854
LF4	12.07	7.509	.752	.871

This analysis has proven that each of these scales shows some strong internal consistency through the results of their reliability tests. The four items placed which are learning flexibility (LF1–LF4), achieved a Cronbach's Alpha score of 0.895, indicating very high-test reliability because all of these items measured the same basic construct. The results of this analysis have also gained some additional credibility as all 73 cases remain valid without exception, proving the data set is eligible for reliability testing. This item total statistic also shows each reliability through the result of the item total correlation value where it is corrected to range from 0.721 to 0.803, which exceeds the accepted threshold of 0.30. This scale measures each item because it needs to provide every important information to know the complete measurement. The results of this item deletion test also show that all of these existing items exert their strength because the overall alpha value still remains higher than the value of a particular item. Therefore, these four items should always remain because they create a reliable measurement tool and can also be used by researchers to obtain more accurate and relevant results.

Scale: Independent Variable 2 (IV2) - Technology Accessibility

Figure 5: Cronbach's Alpha (IV2)

Reliability Statistics	
Cronbach's Alpha	N of Items
.921	3

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
TA1	8.44	4.083	.804	.917
TA2	8.12	4.110	.869	.864
TA3	8.34	4.089	.849	.879

The success of testing on the IV2 Scale shows that it functions as a reliable testing instrument. The three items that have been determined, which are (TA1–TA3), show very high reliability according to Cronbach's Alpha value, which reaches a rate of 0.921. This is because these items also measure several similar constructs that require high consistency. This analysis included all 73 cases because in this case no data was excluded, indicating that each data set contained all the information needed to test reliability. Not only that, the statistics on the number of items also provide some evidence that each of these scales has various strong measurement abilities.

When viewed, all the total correlation values on the total number of corrected items range from 0.804 to 0.869, which is seen to be far above the minimum acceptable level and it also shows that each of these items can contribute strongly to the entire overall scale. Monitoring any item from this scale will also produce some reliability measures that may be lower according to the Cronbach's Alpha value which shows this pattern. Hence, these three items should also always remain in every instrument because with their combined presence, it creates a measuring tool that can provide higher measurement accuracy.

Scale: Independent Variable 3 (IV3) - Educator Supports

Figure 6: Cronbach's Alpha (IV3)

Reliability Statistics

Cronbach's Alpha	N of Items
.938	4

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
ES1	11.92	7.438	.834	.925
ES2	11.82	7.010	.867	.915
ES3	11.73	7.257	.848	.921
ES4	11.84	7.417	.865	.916

Furthermore, the reliability analysis for Scale IV3 also showed some very good internal consistency which produced these results. What can be seen is that these four items (ES1–ES4) received a Cronbach's Alpha value of 0.938, which indicates very high reliability because each item consistently assesses the basic construct at the same level. All of these types of analyses were also included with all 73 cases because no data points were excluded, indicating that the available data set contained all of the complete data needed to perform each of these reliability assessments. In fact, each of these item total statistics further reinforces the strength of each scale.

The corrected item total correlation values range from 0.834 to 0.867, which is also seen to be well above the recommended threshold. Not only that, it also indicates that each of these items can make a stronger contribution to the scale as a whole. This Cronbach's Alpha value also indicates that all of these items should be kept because removing any item, especially from the scale, would reduce its reliability. These four items should be kept because they each create a measurement tool that will provide more robust and reliable results.

Scale: Independent Variable 4 (IV4) - Digital Resources

Figure 7: Cronbach's Alpha (IV4)

Reliability Statistics	
Cronbach's Alpha	N of Items
.940	3

Item-Total Statistics				
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
DR1	8.05	4.497	.866	.922
DR3	7.84	4.334	.854	.930
DR4	8.03	3.888	.914	.884

Besides, reliability tests on the IV4 Scale also show that each of its results maintain exceptional internal consistency. What can be seen is that all three items, which are DR1, DR3 and DR4, each show a very high level of reliability through the Cronbach's Alpha value they obtained, which is 0.940, because each of these items measures the same basic constructs and is also consistent. In fact, all of these analyses also included all 73 cases because this data set did not contain any missing data, making it suitable for reliability testing. The statistics shown, namely the number of items on this scale, prove the strength of the measure. Not only that, the correlation value of the total number of corrected items also shows between 0.854 and 0.914 which exceeds the minimum value required and at the same time it shows that all items can help in the test to build a complete assessment. This Cronbach's Alpha value also indicates that all items on this test should remain as it can create a stronger measurement system.

Descriptive Statistics

Figure 8: Descriptive Statistics

Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
IV1	73	1.00	5.00	4.0034	.89994	-1.575	.281	3.372	.555
IV2	73	1.00	5.00	3.9726	.92942	-1.739	.281	3.293	.555
IV3	73	1.00	5.00	3.9418	.89026	-1.262	.281	2.328	.555
IV4	73	1.00	5.00	3.8973	.99551	-1.432	.281	1.903	.555
MV	73	1.00	5.00	3.8390	.95048	-.787	.281	.365	.555
DV	73	1.00	5.00	3.7055	.89107	-.732	.281	.901	.555
Valid N (listwise)	73								

In this descriptive statistics section, this study also explores how students interact with the main study variables, which are learning flexibility (IV1) and technological accessibility (IV2) and educator support (IV3) and digital resources (IV4) and student perceptions and attitudes (MV) and learning engagement (DV). Respondents used all the options available on the questionnaire which used a Likert scale because they answered the survey with a score between 1 and 5.

Besides, as seen in the diagram, students see online learning as a flexible method where it allows them to control their study schedule according to their needs because learning flexibility shows the highest mean score of 4.0034 among all independent variables. Each of these results shows that students have positive views about the accessibility of technology at ($M = 3.9726$), educator support at ($M = 3.9418$), and also digital resources at ($M = 3.8973$), which reflects their ability to access each technology resource and also receive good help from educators including using digital learning materials. Not only that, students also showed some positive evaluations of overall online learning through the assessment of student perceptions and attitudes on the mediator variable ($M = 3.8390$) while they also showed moderate to high levels of engagement in their online learning activities by having a learning engagement assessment at ($M = 3.7055$).

Furthermore, when looking at the skewness values for all these available variables, they show negative skewness because each of their data distributions shows values between -1.739 and -0.732 . This is because, research results have shown that most students prefer to answer survey questions using higher scale values because when seen, they more often choose "Agree" and "Strongly Agree" compared to other or lower answer options. Next, the kurtosis value is within the acceptable range and it shows no severe deviation from normality. This section of data also shows several normal distribution patterns which allow researchers to conduct statistical tests that include various correlation and regression analyses. In addition, the results of this study show that students at UiTM view their online learning environment positively while maintaining their engagement in academics better and at the same time also being able to create a solid foundation for examining the relationships between study variables.

Hypothesis Summary

Table 9: Hypothesis Summary

Variables	Correlation Coefficients (r)	Significance (p)	Relationship	Hypothesis
Learning Flexibility - Students' Perceptions and Attitudes	0.619	<0.01	Strong Positive	H1 Supported
Technological Accessibility - Students' Perceptions and Attitudes	0.578	<0.01	Moderate	H2 Supported
Educator Support - Students' Perceptions and Attitudes	0.652	<0.01	Strong Positive	H3 Supported
Digital Resources – Students' Perceptions and Attitudes	0.632	<0.01	Strong Positive	H4 Supported
Students' Perceptions and Attitudes - Learning Engagement	0.812	<0.01	Very Strong Positive	H5 Supported

This study used several correlation analyses to further examine the relationship between six different aspects, which are learning flexibility, technological accessibility, educator support, digital resources, and student perceptions and attitudes, as well as their engagement in learning. Each of these results shows that all of these independent variables show a positive and significant relationship to student perceptions and attitudes where the mediating variable is at a significance level of 0.01.

On the learning flexibility variable, it shows a strong positive correlation with student perceptions and attitudes because each of these relationships has a correlation coefficient of $r = .619$ and also a statistical

significance level of $p < .01$. Not only that, when looking at the relationship between technological accessibility, educator support and digital resources with student learning outcomes, it shows a large positive relationship with research value, which are at $r = .578$ and $p < .01$ and $r = .652$ and $p < .01$ and $r = .632$ and $p < .01$, respectively. Each of these findings can provide some evidence that supports hypotheses H1, H2, H3 and H4 because this research shows that any increase in flexibility and better access to technology, including increased educator support and better digital resources, leads to more positive student perceptions of online learning.

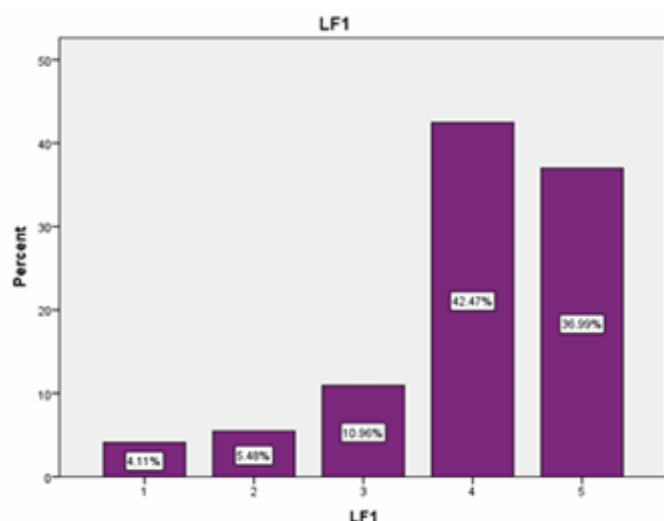
Moreover, this study also found that some students' learning engagement was positively correlated with their perceptions and attitudes towards learning ($r = .812$, $p < .01$), which supports H5. This study also shows that students who have positive attitudes and perceptions about their online learning are more likely to participate in some of their educational activities. Hence, the independent variables also show some positive correlations with learning engagement, which indicates that both direct and indirect relationships exist between the variables.

Frequencies

Learning Flexibility

Learning Flexibility 1: I can choose when to complete my online learning tasks.

Figure 10: Learning Flexibility 1

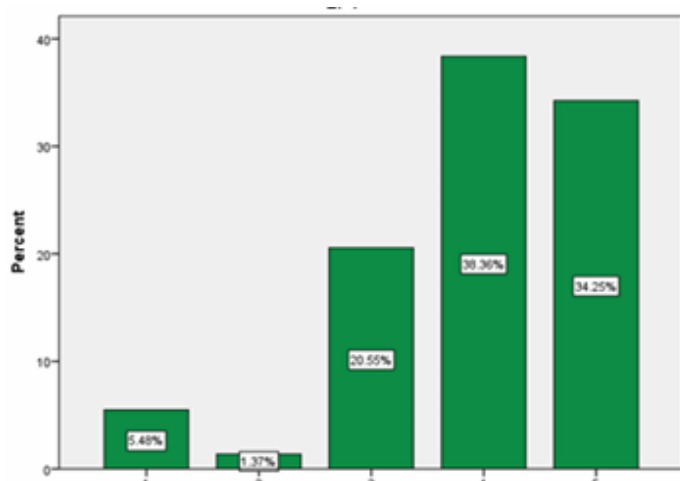


The bar chart above illustrates some of the student responses to this item, "I can choose when to complete my online learning tasks," which represents one aspect of learning flexibility. The distribution of each of these responses shows that the majority of students chose the higher end of the Likert scale in relation to this item. When seen, 42.47% of respondents chose a scale of 4, which is Agree, and 36.99% chose a scale of 5, which is Strongly Agree. These results show that approximately 80 percent of respondents believe that online learning allows them to choose their own study time.

The student population on this item also showed minimal disagreement at the level of 4.11% by choosing scale 1 and also 5.48% chose scale 2 and then 10.96% chose a neutral position which is scale 3. With the results of this study, these results show that most students at UiTM Puncak Perdana see learning flexibility as one of the advantages of their online learning environment. This ability to choose their own study schedule allows each student to achieve their academic goals while maintaining personal obligations, which will result in lower stress levels and can also lead to better academic performance. The conceptual framework in this study also suggests that students who perceive online learning as flexible will develop positive attitudes towards it and will lead to an increase in learning engagement.

Learning Flexibility 2: I feel that online learning provides me with more control over my study time.

Figure 11: Learning Flexibility 2



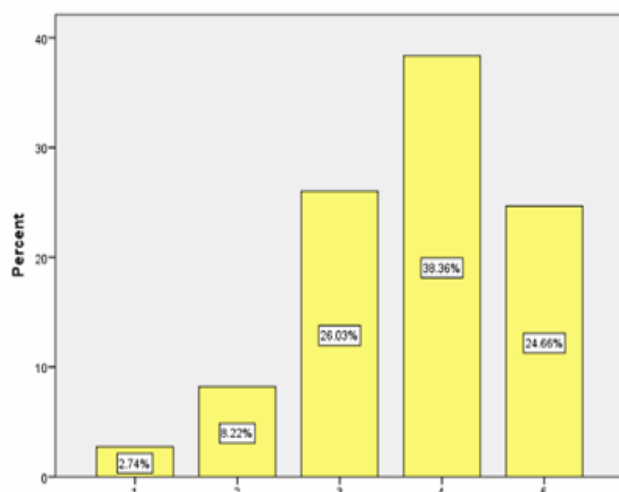
The distribution of responses for Learning Flexibility 2 (LF2), which is on “I feel that online learning provides me with more control over my study time.”, shows that a number of students have a positive view of their online learning because it allows them to control their study time. The majority of these respondents chose a higher level of agreement on a scale of 4, which is 38.35% percent agree, and 34.25% percent of them chose to strongly agree, which is 5 on a scale, about online learning giving them greater control over their own study schedule. The results of this item study showed that more than two-thirds of these respondents viewed their online learning as flexible because it allowed them to control their study time and also served as one of the main benefits of the digital learning environment.

Besides, the results of this survey also show that only a small group of people shared their opinion that they were not biased or gave a negative response to the statement. There were also approximately 20.55% of respondents who chose the neutral option on a scale of 3 and this indicated some uncertainty or even mixed experiences regarding time control in their online learning. Participants also showed minimal satisfaction with this statement as only 5.48% of users disagreed and there were also 1.37% of users who chose to strongly disagree. Therefore, the results of this study show that each online learning platform can provide students with many advantages and also give them meaning through their own ability to control their study time.

Students' Perceptions and Attitudes

Students' Perceptions and Attitudes 1: I believe online learning is an effective way to learn.

Figure 12: Students' Perceptions and Attitudes 1

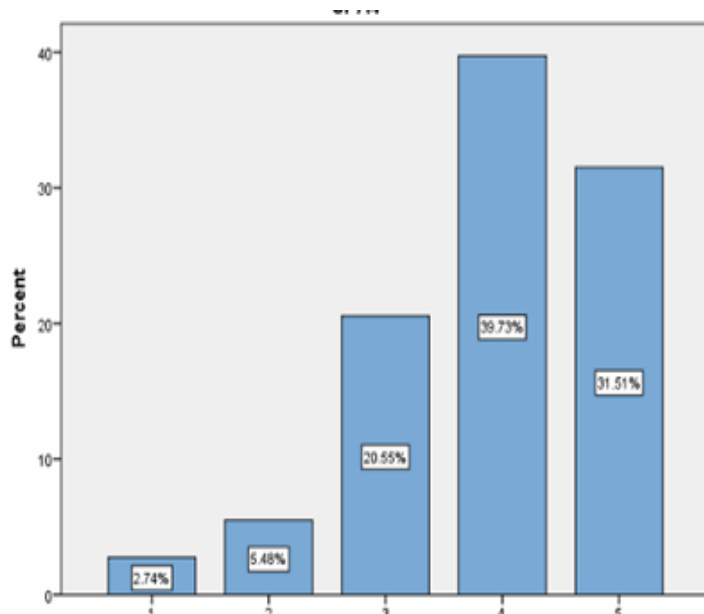


The distribution of responses for SPA1 related to "I believe online learning is an effective way to learn" indicates that most students believe they can learn effectively through online platforms. When seen from the graph above, the majority of students find their online learning environment helpful and easy to navigate for them according to the results which show that most respondents chose to agree on a scale of 4 by 38% and strongly agree on a scale of 5 by 24%. In fact, the highest percentage of responses fell under the agree category, indicating that most students believe they can learn effectively in online learning.

Scale 3, which is neutral and even disagreeable, can be said to be at a small level from respondents, indicating that each student's level of confidence varies across the entire student population. This situation can also arise from three main factors, which are limited digital abilities, individual learning styles and also technology accessibility issues. This response pattern also shows some positive support for online learning as these students will demonstrate their comfort and confidence when using the online platform.

Students' Perceptions and Attitudes 2: Overall, I have a positive attitude towards online learning.

Figure 13: Students' Perceptions and Attitudes 2



This SPA2 bar chart shows the results of the statement "Overall, I have a positive attitude towards online learning" which reinforces a positive perspective on online learning. The majority of these respondents chose a scale of 4, which was approximately 39.7%, while a scale of 5 contributed to 31.5% of the responses. These results show that most of these respondents expressed positive feelings about online learning, which shows their acceptance and ability to adapt to this learning method.

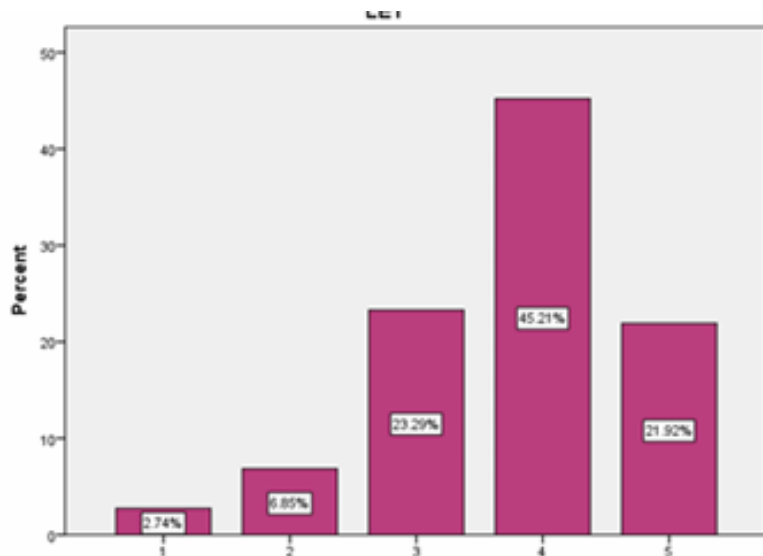
Not only that, this response capacity also exists for low-scale responses. There were also respondents who chose scale 3, which accounted for approximately 20.5%, indicating that this group of respondents felt neutral or unsure about their online learning. The combination of responses on scales 1 and 2 indicates that only a small number of students have negative attitudes towards their online learning, which makes up less than 10% of the total response results.

The results of this research show that most students still maintain their positive views towards online learning, but there is also a small group of these students who need additional help to improve their overall experience during this online learning.

Learning Engagement

Learning Engagement 1: I actively participate in online class discussions.

Figure 14: Learning Engagement 1



The distribution of responses on Learning Engagement 1 (LE1) related to the statement "I actively participate in online class discussions" shows that some students actively participate in online class discussions at a positive level. The largest percentage seen in this diagram is that most respondents chose the agree option on a scale of 4, which is 43.84%, followed by 21.92% on a scale of 5, which strongly agree. This shows that the majority of students are actively involved in discussions during their online classes. These results also show that several of the existing online learning platforms can provide students with sufficient opportunities to interact with each other, including with lecturers, while they study.

The results of this survey showed that there were also some participants who chose to remain neutral about their level of participation in the discussions during class. Approximately 23.29% of respondents chose the neutral option, which indicates that some students may participate in discussions but not consistently or only occasionally in online discussions. The results of this study also showed that only 9.59% of participants faced problems participating in online discussions. These results show that most students actively participate in online discussions, but that additional methods need to be developed to further increase participation from less involved students.

DISCUSSION AND CONCLUSION

In conclusion, a positive student perception of online learning is inextricably linked to a flexible educational environment, accessible digital infrastructure, effective pedagogical support, and high-quality digital resources. Collectively, these factors establish critical pathways that significantly enhance student engagement and participation within digital learning modalities. The intersection of these variables ultimately determines the extent to which learners immerse themselves in academic activities and fully realize the benefits of online education.

Furthermore, this study contributes valuable empirical insights that advance the existing literature on online learning within higher education, particularly within the context of Universiti Teknologi MARA (UiTM). The findings offer dual contributions, providing theoretical advancement to the field of digital pedagogy and practical implications for institutional strategic development. To provide a comprehensive overview, the subsequent sections will outline the inherent limitations of this study and suggest prospective directions for future research.

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