# A Pilot Analysis of Factors Affecting Satisfaction of Using Interactive Digital Whiteboard Among University Postgraduate Students

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Received: 4 May 2025

Received in revised form: 10 May 2025

Accepted: 20 May 2025

Published online: 27 June 2025

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#### Abstract

The COVID-19 lockdown sparked a transformation in educational approaches worldwide and transformed the traditional learning to online engaging learning. Even so, this transformation has demonstrated the need to implement interactive e-learning technologies on many occasions, and this allows lecturers to help students flexibly develop their soft and technical skills required by the course they are attending. As a result, more online learning, like ODL and using a blended learning method, emerged. Therefore, it is important to understand students' satisfaction of using interactive online technology into their learning whether for attending online lectures or facilitating group discussions. This study piloted a survey on fifty Universiti Teknologi Malaysia, Kuala Lumpur (UTMKL) postgraduate students who attended online courses. This study aims to explore the clarity, reliability and validity of the questionnaire before a full-scale study takes place. An evaluation of the instrument's reliability was conducted using Cronbach's Alpha, alongside an evaluation of indicator reliability through outer loadings. The study revealed that all factors namely perceived usefulness, perceived ease of use, perceived ease of learning, perceived interaction, perceived motivation and perceived satisfaction are reliable to be postulated as the hypotheses in developing a model to explore how perceived usability factors influence postgraduate student satisfaction with the use of the interactive digital whiteboard UTMKL. The results of this pilot research offer important information about possible factors from usability perspectives to measure satisfaction of using interactive learning tools in teaching and learning. To create a thorough model of satisfaction factors, future studies will increase the sample size and apply inferential statistical methods. Promoting interactive learning at UTMKL and other comparable environments can be explored further by this study, which also may add the expanding corpus of research on the use of technology in education.

Keywords: Interactive Digital Whiteboard, Satisfaction of Use, Higher Education, Pilot Study

## 1. Introduction

The swift proliferation of coronavirus (COVID-19) has posed significant threats to public safety, the economy, and education. It profoundly affected educational institutions globally, effectively closing schools, colleges, and universities. Consequently, education serves as the cornerstone for personal development and

the enduring sustainability of any community. During the COVID-19 pandemic, it is essential to deliver consistent and effective teaching; several countries' educational institutions shifted from in-person to online training [1]. Thus, interactive digital whiteboards incorporate many learning methods into a unified experience, are pristine and necessitate minimal maintenance, and do not require chalk, markers, or any other writing instruments [2].

Environmental motivations have consistently had the major influence on students' learning goals. The literature has examined effective learning environment incentives for fostering students' intrinsic motivation and aiding them in obtaining essential information and skills to achieve desired outcomes. Moreover, institutions bear the responsibility of cultivating an optimal learning environment that fosters effective educational outcomes. They also found that in such an atmosphere, students would gain from peer support, revised curricula, and enhanced instructional procedures [1]. Although the significance of active and interactive learning in online educational environments has been established, research regarding the influence and effects of digital technologies on active learning, feedback, and repetition during lectures remains scarce. The scarcity of research is particularly apparent with emerging digital platforms as interactive digital whiteboards [3]. The increase in the use of interactive digital whiteboards in educational settings has notably transformed conventional teaching methods and learning experiences. The use of interactive digital whiteboards in classrooms marks a notable shift from traditional chalkboards or marker pens, promoting a more dynamic and engaging educational environment for students [4]. The effectiveness of interactive digital whiteboards depends on the educational strategies utilized by educators and the degree to which students recognize their value in enhancing learning. The incorporation of interactive digital whiteboards aims to improve class effectiveness by equipping educators with a multifunctional tool that facilitates knowledge transmission, promotes collaboration, and supports diverse learning styles [5]. These boards potentially provide an immersive and enhanced learning experience compared to traditional methods by integrating multimedia, real-time annotation, and interactive simulations. Hence, it is essential to identify and understand factors affecting student satisfaction with interactive digital whiteboard technology to maximize its benefits in higher education and support its implementation. Analyzing the factors influencing student satisfaction with interactive digital whiteboards is essential for enhancing their effectiveness and improving educational outcomes [6]. Student satisfaction is a multifaceted construct influenced by various factors.

This study aims to understand the satisfaction derived from using this technology among university students, considering several perceived usability-related factors through a pilot study. This study aims to develop measurement tools for assessing satisfaction, which will be applied to quantitatively validate the satisfaction model of interactive digital whiteboards in subsequent research. A pilot study serves as a small-scale trial run of all procedures, constituting a critical element in the data collection process [7] and assists in assessing the reliability and validity of the measures to be employed in the main study [8]. This study aims to identify relevant items for measuring satisfaction of using interactive digital whiteboard among university students in UTMKL, thereby examining the reliability and validity of these items.

### 2. Literature Review

### 2.1 Interactive Digital Whiteboard

Interactive digital whiteboards provide a platform for real-time collaboration and communication among multiple users. These tools facilitate text exchange, drawing, image sharing, document or link distribution, chatting, and interaction on shared screens. Users have the option to save their work for subsequent reference. Features such as name tags and unique cursors are employed to identify contributors, enabling team members to monitor the cursor movements of others actively engaged on the board. The examples of recent interactive digital whiteboards include Microsoft Whiteboard, Miro Board, Twiddla, Google Jamboard, Blackboard and Ziteboard. Studies also demonstrate that initial versions of interactive digital whiteboard such as smart board significantly improve learning outcomes in fields such as computer science [9], physics [10], and even music [11].

### 2.2 Review of Related Satisfaction Models in Education

Recognizing the critical aspects affecting user satisfaction has become vital due to the significant increase in the use of interactive digital whiteboards in business and educational settings. User satisfaction is frequently analyzed using known theoretical frameworks, including the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Technology Acceptance Model (TAM). The models demonstrate several factors that influence intention to use and satisfaction and these include these independent factors: perceived usefulness, ease of use, performance expectancy, and expectation confirmation. Recent improvements in these models have incorporated collaborative features, such as system motivation, ease of learning and interactivity as critical determinants of satisfaction with digital interactive whiteboards. Literature review of prior research on perceived usability and its impact on user satisfaction in both e-learning interactive tools and interactive digital whiteboards reveals a summary of findings as shown in Table 1.

Authors and Context	Model Derivation and Factors	Key Finding	
[12] (Student estisfaction on	Perceived Usefulness,	Perceived usefulness	
(Student satisfaction on	Perceived Ease of	significantly affects	
online learning)	Use, Attitude, Student	student satisfaction.	
	Satisfaction		
[13]	Perceived Usefulness,	Perceived usefulness and	
(A study of perceived ease	Perceived Ease of	ease of use significantly	
of use and perceived	Use,	affect student satisfaction.	
usefulness on online	Satisfaction		
learning)			

**Table 1. Previous Related Digital Interactive Study** 

[14]	The Modified-Unified	There was a		
(Determinants of	Theory of Acceptance	significant effect on		
Behavioral Intention and	and Use of	teachers' Behavioral		
Use of Interactive Digital	Technology 2	Intention (BI) to use IWB		
Whiteboard by K-12	(UTAUT2)	in remote and rural places		
Teachers in Remote and		that was caused by		
Rural Areas)		Habit and Hedonic		
,		Motivation. Facilitating		
		Conditions (FCs) and		
		Behavioral Intention (BI)		
		significantly positively		
		influenced Usage		
		Behavior		
[15]	Two factors from	Learning motivation is		
[13]	Two factors from	realitively imported by		
(Factors of Learning,	A second	positively impacted by		
Satisfaction in Blended	Acceptance Model	perceived usefulness and		
Learning)	together with learning	perceived ease of use.		
	motivation and	Motivation for learning		
	learning satisfaction	positively influences		
		learning satisfaction.		
		Perceived usefulness, as an		
		intermediate element of		
		perceived ease of use,		
		exerts an indirect influence		
		on learning motivation.		
[16]	Instructor support,	Although the perceived		
(Student satisfaction with	interaction,	satisfaction with e-learning		
e-learning)	satisfaction	was rated low, student		
		interaction and		
		collaboration were		
		significant.		
[17]	Student motivation.	Student Perceived		
(Perceived learning and	course structure.	Learning Outcome		
satisfaction outcome in	instructor knowledge	significantly affects		
online learning)	and facilitation are	Satisfaction Interaction		
omme rearrang)	positively influencing	was also found		
	students?	significantly affecting		
	nerceived learning	Perceived Learning		
	outcome and student	reiceived Learning.		
	satisfaction			
	satisfaction.			

After reviewing a few relevant works from previous research, we discovered that not all literature could be used for evaluating an interactive digital whiteboard's satisfaction. This study examined various important empirical factors highlighted in prior literature. Consequently, pertinent factors influencing the usability of interactive digital whiteboards were identified, and literature review methods were used in several other studies on the same subject. Table 2 displays the results of selected factors derived from prior literature studies, highlighting several factors from human and technological dimensions that may considerably influence student satisfaction with the interactive digital whiteboard as a learning tool.

Causal Factors / Constructs	Previous Empirical	
	Evidence	
Perceived Usefulness towards Satisfaction	[12 -13], [18-20]	
Perceived Ease of Use towards Satisfaction	[13], [18-19]	
Ease of Learning towards Satisfaction	[17], [20]	
Interaction towards Satisfaction	[17], [21]	
Motivation towards Satisfaction	[17]	

**Table 2. Significant Causal Relationships** 

### 3. Methodology

This pilot study utilized quantitative research methodology to evaluate the validity and reliability of the dependent satisfaction items alongside the chosen independent factor items. The pilot study constitutes the second phase of the overall methodology, following the literature review. The questionnaire was converted into a survey format, enabling the collection of quantitative data through an online survey. All instruments utilized to assess each latent variable were selected and modified in accordance with a review of previous research. The target population for sampling consisted of UTM students who used and were exposed to the interactive digital whiteboard. The process consisted of two phases: the first phase required acquiring expert comments on the questionnaire's content, while the subsequent step comprised distributing the pilot survey to respective students. Considering the importance of the questionnaire's content, three experts were solicited to evaluate it prior to the pilot study. A survey questionnaire form was distributed online via Google Forms, an effective tool for survey creation and distribution, was used to track responses, since it is a straightforward and reliable digital platform at this era. Measurement items were designed to align with the items representing each individual variable. Subsequently, after the collection of answers from participants, the data was analyzed via the statistical program SmartPLS.

The survey instrument employed in this study comprises five independent factors and one dependent factor. The survey consists of 30 items corresponding to all six variables outlined in the model with modification to the context of the study. The six variables and their corresponding initial items are as follows: perceived usefulness (5 items), perceived ease of use (5 items), perceived ease of learning (5 items), perceived motivation (5 items), perceived interaction (5 items), and student satisfaction (5 items). The survey form is structured into two sections. Section A collects demographic data regarding the respondent's profile. Section B addresses the perspective of independent variables and satisfaction as the dependent variable. Sections B utilize five (5) point Likert scale questions.

#### 4. Result

During the initial phase, three specialists were engaged to evaluate the questionnaire, which comprised 30 indicators across all six factors. Three qualified reviewers were chosen from among lecturers who specialize in information systems and those who utilize interactive digital whiteboards in their teaching. Building upon the initial phase, a pilot survey was executed involving 50 university students from the Faculty of Technology and Informatics Razak, who were asked to respond to the survey questionnaire. The survey was constructed and disseminated using Google Form. The next phase involves executing a pilot survey to assess the reliability of each item or question within the survey questionnaire.

#### 4.1. Descriptive Analysis

This pilot study reported on selected demographic profile, including gender, age, course specialization, the type of interactive digital whiteboard utilized, and the frequency of tool usage. The final survey included 50 participants. The majority of the respondents (82.8%) were male, whilst 16.2% were female. Participants were categorized into five age categories. The predominant age group was 35–39 years, with 31.3%, followed by the 40+ age group at 28.3%. The sample included 23.1.1%of individuals aged below 29. This distribution indicates that the majority of the participants were mid-aged. Participants had varied academic backgrounds. The majority were from Engineering (46.5%), followed by IT (19.2%), Business Administration (11.1%), and Science (9.1%). Built Environment & Surveying (2.0%), Accounting (1.0%), and Other (7.1%) had a lower number of responses. This indicates that technical and engineering fields predominate in the sample. The most often cited interactive teaching tool was the Windows Whiteboard software (37.4%), followed by Jamboard (22.2%) and Canvas Chrome (20.2%). Whiteboard.chat was used by 11.1%, while other tools accounted for 7.1%. 59.6% of respondents said that they sometimes use interactive devices during lectures, whilst 36.4% reported that they always do. Merely 3.0% use them seldom. These studies demonstrate effective engagement using interactive pedagogical techniques.

### 4.2. Pilot Analysis

After removing specific items because of a slightly lower Cronbach's alpha value (0.6 - 0.79), the analysis was re-executed by redistributing the questionnaire to gather more responses. The outcome is derived from feedback of 50 participants, an increase from the initial participation of 30. We employed SmartPLS statistical software to compute the Cronbach Alpha and outer loading values for each individual item to assess the internal consistency and reliability of the items corresponding to each proposed factor. The conclusive items and analysis outcome of this pilot study are presented in Table 3. The final total number of items derived from the pilot study is 25.

Construct	Item	Outer	Cronbach
		Loading	Alpha
Perceived	PU1: Using the interactive digital	0.844	0.865
Usefulness	whiteboard, I expect to improve my		
(PU)	study process.		
	PU2: Using the interactive digital	0.070	
	whiteboard, I expect to improve my	0.8/9	
	PU3. Using the interactive digital		
	whiteboard Lexpect it will improve my		
	productivity.	0.796	
	PU4: It is easy to work collaboratively		
	with other students using the interactive		
	digital whiteboard.		
		0.780	
Perceived	PEOU1: I found it was simple to use the	0.759	0.816
Ease of Use	interactive digital whiteboard.		
(PEOU)	PEOU2: I expect that it will be easy for	0.805	
	me to become skilled with the		
	<b>PEOU2:</b> Using the interactive digital	0.820	
	whiteboard makes it easier to reach	0.820	
	different sources and display them to the		
	whole class immediately.	0.824	
	PEOU4: I was able to access the		
	materials on the interactive digital		
	whiteboard without much difficulty.		
Perceived	PEOL1: I learn more when the lecturer	0.738	0.822
Ease of	uses the interactive digital whiteboard.		
Learning	PEOL2: I found the opportunity to learn	0.047	
(PEOL)	from different sources with the use of	0.847	
	The interactive digital whiteboard.	0 776	
	lecture when the lecturer uses the	0.770	
	interactive digital whiteboard		
	PEOL4: I found the interactive digital	0.853	
	whiteboard to facilitate communication	0.000	
	and learning among students	0.809	
	PEOL5: I found the information on the		
	interactive digital whiteboard screen is		
	well organized.		
Perceived	PI1: I expect the interactive digital	0.772	0.891
Interaction	whiteboard to enhance interaction		
(PI)	between students during the lecture	0.015	
	r12: I believe that the use of the	0.815	
	student participation in the discussion		
	student participation in the discussion.		

Table 3. Pilot Study Result

	PI3: I expect that the interactive digital	0.830	
	whiteboard will make learning more		
	enjoyable and interesting.		
	PI4: Using the interactive digital	0.811	
	whiteboard allows me to share learning		
	resources with other students.		
Perceived	PM1: I believe it is easier to keep my	0.852	0.851
Motivation	attention when using the interactive		
(PM)	digital whiteboard during the lesson.		
	PM2: I expect that using the interactive	0.897	
	digital whiteboard makes me motivated		
	during the lesson.		
	PM3: I expect that using the interactive	0.891	
	digital whiteboard increases my interest		
	in the lesson.	0.831	
	PM4: I expect that the interactive digital		
	whiteboard will make learning more		
	enjoyable and interesting.		
Satisfaction	S1: I feel satisfied with the interactive	0.788	0.844
(S)	digital whiteboard that I currently use.		
	S2: The interactive digital whiteboard	0.910	
	meets my expectations.		
	S3: I felt very confident using the	0.822	
	interactive digital whiteboard.	0.000	
	S4: I felt that the interactive digital	0.806	
	whiteboard is efficient.		

The internal consistency reliability was examined by Cronbach's Alpha coefficients for each factor. All constructs demonstrated acceptable to high reliability, as shown by Cronbach's Alpha values beyond the required level of 0.70. Outer loading is applicable and advisable in a pilot study, particularly when employing reflective measurement models. Outer loading denotes the relationship between each observed variable and its corresponding latent construct in reflective measurement. A widely recognized benchmark for outer loadings is 0.70 [22], signifying that more than 50% of the variation in the observed item is explained by the latent component. Loadings under 0.70 may be accepted if the overall build dependability, such as Cronbach's Alpha or Composite dependability, is robust. Hence, the outer loadings for all items exceeded 0.70, affirming the convergent validity and that the measuring items utilized in this pilot study are reliable and valid. These results indicate that the construct is well represented by its indicators.

# 5. Discussions & Conclusions

This pilot study aimed to investigate the primary factors affecting postgraduate students' satisfaction with the use of interactive digital whiteboards in online learning environments. The findings indicate that all six constructs perceived usefulness, perceived ease of use, perceived ease of learning, perceived interaction,

perceived motivation and satisfaction demonstrated high reliability and validity, supported by adequate Cronbach's Alpha values. This research sought to validate a measurement model examining the factors that affect postgraduate students' satisfaction with interactive digital whiteboards in an online learning context. The findings offer substantial preliminary support for the reliability and validity of the constructs and measurement items, endorsing their application in future The primary objective of pilot studies is to refine comprehensive research. instruments, evaluate feasibility, and confirm that constructs function as anticipated, rather than to generalize findings. These results closely align with the findings of [23], who conducted a pilot assessment of Miro and Jamboard in virtual collaborative classrooms, when compared to other pilot or exploration studies. Their study highlighted the significance of perceived interaction and motivation, indicating that students experienced greater connection and engagement during group tasks facilitated by interaction digital whiteboard. Similar to the current investigation, their preliminary data acted as a foundation for more extensive research, aiding in the refinement of constructs and the validation of the theoretical model.

This study contributes to the existing evidence that interactive tools improve learning experiences in higher education. This pilot's emphasis on postgraduate students offers valuable insights. Postgraduate learners typically interact with more intricate content and require increased autonomy in their educational approaches. Consequently, factors such as Perceived Motivation and Ease of Learning assume greater significance. This finding is corroborated by [24] who observed in their pilot study on digital pedagogy for postgraduate learners that motivational affordances had a significant impact on satisfaction and the continued use of digital platforms. The preliminary findings establish a robust basis for comprehensive study and enhance the overall comprehension of effective technology integration in online postgraduate education.

#### Acknowledgments

Acknowledgement to Faculty of Artificial Intelligence, Universiti Teknologi Malaysia for their support and UTM Academic Grant Q.K130000.2757.03K69.

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