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FACTORS AFFECTING THE USE OF TABLETS IN THE LEARNING PROCESS OF PRIMARY SCHOOL STUDENTS IN SAUDI ARABIA

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ABSTRACT

In the current digital era, distance learning has become the first trend that has dominated all other educational trends. The COVID-19 pandemic has drastically changed teaching and learning methods. Due to social distancing, students have become accustomed to distant learning via digital platforms. One of the most difficult challenges students confront is the lack of engagement in the educational process. This paper explores the problem of lack of engagement in distance learning and investigates the relationship between tablet use and student engagement. A survey questionnaire was developed and distributed among 279 primary school students in Saudi Arabia using a quantitative methodology. The results reveal that hedonic motivation is the most significant factor affecting student engagement, followed by the facilitating condition factor, while performance expectancy has the least effect. These findings can inform policymakers in the Saudi educational sector about the importance of appropriate human resource management practices to improve student performance. Furthermore, the study suggests exploring the moderation effect of major groups such as students' study course, age, gender, and study phase on the relationship between the studied factors and students' engagement in the learning process. Overall, this study highlights the importance of using digital platforms to engage students in the learning process, especially in the current distance learning era.

Keywords: *Students' Engagement, Education, Technology, Distant Learning, Hedonic Motivation, Saudi Arabia, Tablet, COVID-19*

1. INTRODUCTION

Without incorporating the latest innovations and technology with industrial expansion, the education sector will encounter considerable challenges to develop and remain viable in the current digital era. In Saudi Arabia, the government strives to support the Saudi education sector to develop and integrate various technological approaches to provide students with the most up-to-date expertise and skills to be leaders throughout the ensuing decades [1]. In this regard, students' engagement with the intellectual work of the school is key for their achievement and social and cognitive development. Previous studies have documented unsatisfactory levels of student engagement, particularly in the traditional classroom setting [2]. One of the most serious issues confronting the Saudi education sector is the unsatisfactory level of students' academic performance, which can be attributed to the students' low engagement level when traditional teaching methods are used in the learning process [2].

Therefore, identifying the factors that significantly affect the students' level of engagement in the learning process is the main objective of this paper. Previous studies revealed that student engagement is significantly lower while using traditional teaching methods compared to the incorporation of various educational tools, technologies, and innovations [2,3]. In the available literature, several factors contributed significantly to the student's level of engagement, including communication, collaboration, active involvement in learning activities, and enriching educational experiences. Moreover, it was found that interaction between students and teachers, the academic challenge level, and the supporting classroom environment are key factors, which affect students' engagement in the learning process [4–6]. Several frameworks and approaches were introduced in the literature to examine the relationship between the use of new technologies and students' engagement and academic achievement [7–9]. However, the use of tablets as a supportive learning tool in primary schools in Saudi Arabia has not been addressed in previous studies. Therefore, this study aims to investigate the factors that significantly affect the use of tablet devices as a learning tool in the learning process in Saudi Arabia. Tablets are a supportive tool to achieve students' engagement so that their

academic performance is improved. This study addresses a key aspect of the learning process: students' participation and engagement in the educational process. Furthermore, the literature has highlighted the importance of accomplishing stable educational growth and effective incorporation of advanced technologies of the 4.0 industry and its applications, especially in the context of Saudi primary and secondary schools [10,11]. This study investigates the factors affecting the use of tablets by Saudi primary school students in the learning process. To this end, a field study has been conducted to identify these factors in the Saudi educational context.

This study mainly aims to address the significant direct effect of the use of tablet devices on primary school students' engagement in the learning process. This study also investigates the significant indirect effect on Saudi primary school students' engagement by mediating the tablet use variable [12,13]. Previous studies in the literature proposed the UTAUT theory as a fundamental theoretical concept to explain the levels of acceptance and adoption of innovative technologies and tools by users, notably the use of the PC tablet in this study. The UTAUT theory suggests several factors, such as performance expectancy, effort expectancy, social effect, habit, and hedonic motivation, as the main factors that positively affect the intention to use or adopt new technological tools in the learning process.

Through the establishment of a strong theoretical foundation on the relationship between tablet use and student performance, this study has the potential to significantly contribute to the development of effective education policies in Saudi Arabia. The insights gained from this research could help primary school officials and education policy makers identify crucial factors for enhancing student engagement and performance, and to implement suitable methodologies for incorporating tablets into the classroom setting. Ultimately, this study's significance lies in its potential to elevate the standard of education in Saudi Arabia's primary schools, ultimately benefitting students and the broader society.

2. LITERATURE REVIEW

2.1. Saudi Education System

In Saudi Arabia, the primary education system started in the 1930s. By 1945, King Abdulaziz bin Abdelrahman Al-Saud, the Kingdom's founder, had begun an intensive program to establish schools in the Kingdom of Saudi Arabia (KSA). Six years later, in 1951, there were 226 schools in KSA. The Ministry of Education was established in 1954, and primary government schooling for girls started in 1964. In the late 1990s, three were schools for girls in every part of the Kingdom. Today, female students make up over half of more than 7.5 million students enrolled in Saudi schools and universities [14].

As a continuation of the Saudi Ministry of Education's main goal to achieve high-quality education and possible outcomes, up-to-date technologies and innovations were integrated into the education system in Saudi Arabia. The ministry has mainly encouraged Saudi schools to implement new technologies and approaches to learning, and schools were encouraged to allow students to use laptops and tablets instead of paper books and notebooks. The goal is to ensure the students' engagement and enhance their involvement in various educational activities to motivate them and increase their productivity [14].

In the context of the recent remarkable development and transformation of Saudi Arabia's education system, compared to the 1932 Kingdom era, education was restricted to a tiny population sector, including children of wealthy family homes living in main Saudi cities. Today, the education system in Saudi Arabia consists of over fifty more scheduled public and private universities, colleges, and universities. The system is open to all residents and offers students free education, books, and health service [15]. In Saudi Arabia, primary education officially began in the 1930s. By 1945, King Abdulaziz bin Abdelrahman Al-Saud, the founder of the royal government, had begun a comprehensive project to set up powers within the royalty[15]. According to the statistics of 2021, the number of schools in the Kingdom reached 38,150, whereby the number of male and female teachers exceeded 500,000, and the number of female and male students exceeded 5 million [16].

2.2 Use Of Tablets Education System

In the past decade, the use of technology in classrooms has grown at all education levels, including primary education, high school, and higher education worldwide. Gabriel et al. (2012) demonstrated that first-year students at universities could choose the content of their lectures via electronic communication. Kim et al. (2006) highlighted communication improvements in classroom technology. In the classroom, mobile technologies, including laptops and tablets, were the investigation's focus. Laptop use in higher education institutions has been extensively studied in the literature [19,20]. Previous studies showed improved

communication between students and between students and faculty, increased student engagement, and improved student organizing skills among students.

Lauricella and Kay (2010) found that students positively perceive using technology in the classroom. Nonetheless, laptops may have adverse effects on student learning. Studies showed that laptops had caused a distraction in the classroom, both for students and for laptop user neighbours (i.e., students who are sitting beside those who use laptops will be distracted, too [20,22,23]. Conversely, tablets have multiple advantages, including improved key thinking, cooperation, and communication skills [24,25]. Furthermore, Goral (2011) found another added benefit: tablets make reading cheaper electronic textbooks more convenient because they can be used in a broader array of settings compared to laptops in the classroom. However, their adoption was not always successful, despite the high educational advantages of tablets. Fischman and Keller (2011) and Wieder (2011) have described some program failures because students cannot quickly adapt to the touchscreen user interface.

Students' positive attitudes toward using tablet technology in the learning process have been reported by [27–29] recommended using this technology and emphasized that students have adequate academic activities to complete with the tablet to assess the value of the technology and not be tempted to use it for non-academic purposes in class.

Finally, the relationship between the tablet usage and the students' engagement was addressed in several studies and proved to have significant effect on their engagement and subsequently on their performance in their calssrooms as shown in Table 2.5.

Table 1: Most important studies that addressed the effect of using tablet on students' engagement

No.	Citation/ Cites	Journal /Research Methodology	Findings
1	[13] **(58 Cites)**	Asian Social Science / Qualitative Case study.	This paper is a report on the use of the iPad in teaching activities over the past 15 months, showing how it can be used to enhance engagement with learning for tertiary students, both those studying live on campus and those studying at a distance.
2	[30] **(21 Cites)**	Journal of Chemical Education /attitudinal surveys	The results from student attitudinal surveys reveal a positive reaction toward tablet-based instruction and the availability of archived lecture notes.
3	[31] **(15 Cites)**	Assistive Technology /Pilot study	One subject appeared to have notably higher participation with the iPad. Individual variations were identified in each student along with some common concerns with attention, task persistence, and goal directed behavior with use of the iPad. Student academic scores improved during iPad use
4	[32] **(13 Cites)**	Journal of Science Education and Technology /Qualitative approach	Students had an intense desire in returning to the site and responded positively toward interacting with nature. Engages students with nature, not technology alone, is a useful tool for keeping students interested in science.
5	[33] **(6 Cites)**	Journal of Educational Computing Research /qualitative content analysis	A qualitative content analysis indicated that students perceived the technological aspects as the main advantage, and barrier, of using tablets for learning. The implications of the results, as well as the role of perceived engagement in enhancing learning outcomes, are discussed in the context of tablet use in learning.
6	[34] **(6 Cites)**	Research Perspectives and Best Practices in Educational Technology Integration /Qualitative Review Analysis	Reviews case studies of three emerging technologies: clickers (or audience response systems), Maple (computer algebra system), and screen casting (using a tablet PC) that have been implemented successfully on one campus to enhance student learning.

2.3 Use Of Tablets Education System in Saudi Arabia

In the late 1980s and early 1990s, the system of education in Saudi Arabia was criticized, despite the generous budgets that forced the Kingdom to depend on many expatriates to fill technical and administrative positions, as well as poorly educated teachers, low retention rates, a lack of

rigorous standards, weak scientific and technical instruction. The King Abdullah Project is an SR9 billion (US$ 2.4 billion) project, which began in 2007 to prepare a qualified workforce; it is one of the most pioneering development projects that improved KSA's education system. Several schools were selected for this project in several cities, like Jeddah, Riyadh, and Dammam in Saudi Arabia. The new program trained more than 400,000 teachers. The project also focused on extracurricular activities to develop students' intellectual, creative, and communicative skills [35].

More recently, many projects have been carried out to support the global trend of digital empowerment in education, including the projects of completion and networking, which are in their early stages. The project of securing and installing computer labs in secondary and middle schools and Saudi schools abroad, in addition to projects of interactive digital content for curricula, communication Digital Remote, creating a new teacher, an educational map, developing a supportive environment for the educational and educational process, and the Saudi Digital Library project [36].

Despite the government's direction toward digitalizing the current education system in Saudi Arabia, studies are limited on this topic. Albiladi and Alshareef (2018) studied the implications and challenges facing using tablets in teaching the English language in Saudi Arabia. Therefore, further studies are needed to assist local policymakers and school directors in improving the performance of this sector.

A few studies investigated using tablets as a supporting tool in education and training activities in Saudi Arabian contexts. In 2018, for example, two studies investigated the tendency of Saudi people to read digital books using tablets [37]. On the other hand, Sarran (2016) conducted a study to investigate the effect of tablet adoption on the reading skills of Saudi female students aged (5-7) years old. Studies have also investigated the effect of adopting Tablet PCs in teaching English subjects or its effectiveness in training courses as an e-assessment tool [39]. More recent studies focused on the digital transformation in Saudi Arabia using Tablet PCs in education, as well as the perceptions toward adopting Tablet PCs in the learning process, especially among children with learning disabilities [40,41].

As a result, using technology and technologies to promote learning and education strategies is very important to the success of both students and teachers. To this end, this study investigates using tablets as a learning tool and education method to improve the overall outcomes of the education process in Saudi Arabia.

As previous studies proved the use of tablets in learning to have significant effect on the students' engagement and subsequently on their performance in their classrooms, this paper mainly aims to address the significant direct effect of the use of tablet devices on primary school students' engagement in the learning process. This study also investigates the significant indirect effect on Saudi primary school students' engagement by mediating the tablet use variable. Accordingly, the following hypotheses was developed and were tested in this study:

- H1. Performance Expectancy has a significant effect on the variable of Intention to use tablet PCs in learning process.
- H2. Effort Expectancy has a significant effect on the variable of Intention to use tablets in learning process.
- H3. Social influence has a significant effect on the variable of Intention to use tablets in learning process.
- H4. Facilitating Condition has a positive effect on the Intention to Use Tablets in learning process.
- H5. Hedonic motivation has a significant effect on the variable of Intention to use tablets in learning process.
- H6. Habit has a significant effect on the variable of Intention to use tablets in learning process.
- H7. Task Characteristics has a positive effect on the variable of Task Technology fit.
- H8. Technology Characteristics has a positive effect on the variable of Task Technology fit.
- H9. Task Technology fit has a positive effect on the variable of Actual usage of tablet PCs by the students in the learning process.
- H10. Tablet intention to use has a positive effect on the variable of Actual usage of tablet PCs by the students in the learning process.
- H11. Tablet actual usage has a positive effect on the variable of students' engagement.

In this study the suggested conceptual framework would be formed of seven independent variables as shown in Figure 1. The main six factors of UTAUT 2 model are namely, Performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motivation and habit. These factors have direct relationship with mediator variable of the same theory which is the intention to use of the tablet devices as a mediator in this case, whereas the other two independent variable of Task characteristics and technology characteristics are adopted from TTF theory and has direct relationship with Task –Technology Fit variable, which in its turn has a direct relationship with Actual usage. Lastly, the DV of this framework would be the student engagement in the learning process.

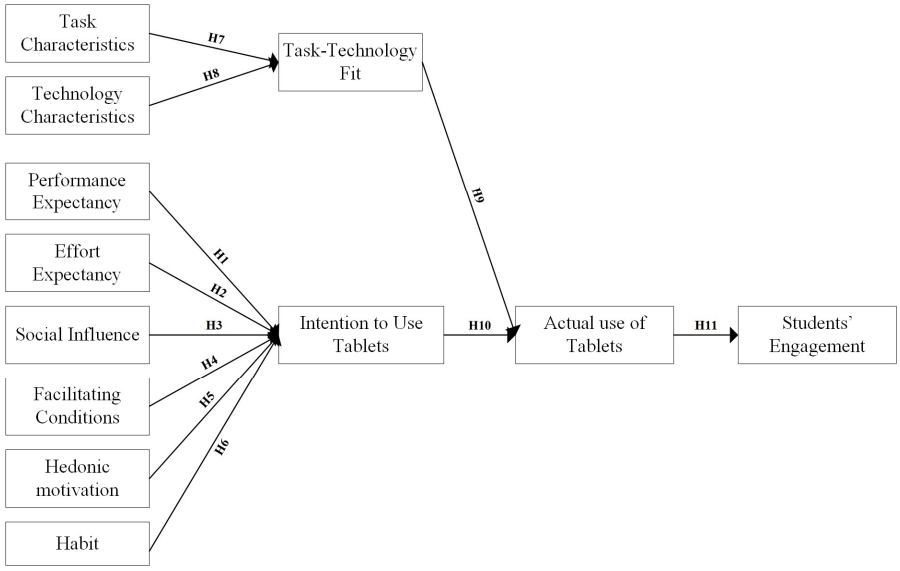

Figure 1: Proposed conceptual framework (hypothesized model)

3. METHODOLOGY

This quantitative empirical study involves hypothesis testing and an exploratory research design. A quantitative approach defines, measures, and examines causal relationships using a statistical analysis technique, namely hypothesis testing [42,43]. Saunders et al. (2009) posited that it could be done using the deductive information-gathering methodology. The hypothesis testing was conducted to examine the direct relationship between the factors derived from the UTAUT and TTF theories.

To analyse the data, a descriptive analysis was initially conducted to outline the respondents' profiles and the constructs of the descriptive analysis, which include the items' mean values and standard deviation values, in addition to the average values of the constructs. After that, the SEM-PLS analysis was conducted to assess the measurement of the model "Constructs Weights, P value, VIF, and Full collinearity," whereby insignificant items were removed. The Path Coefficient and P-values were calculated to assess the conceptual framework's relationships and test the postulated hypotheses. The f^2 "effect size" value was calculated to measure the strength of the relationships between the factors affecting the use of tablets and the student's engagement in the learning process. Lastly, the Goodness of Fit values was presented.

3.1 Study Population and Sample Size

The respondents of this study included students at primary schools in Saudi Arabia, with over 12,500 primary schools in the Kingdom [44]. The randomly selected schools were chosen because their students use tablets in the classroom. This study used the tool provided by Warp PLS, which explores the statistical power and minimum sample size requirement. Three values should be set: the minimum absolute significant path coefficient values in the model (range: 0.01 to 0.99) where the software chose the default value of "0.197" according to the model variables, which are 12 variables. Second, the significance level used (range: 0.001 to 0.5) and the value used is "0.05", and the power level required (range: 0.5 to 0.99) in this case, the power level required was set to the value of "0.95", which is too close to the max Value of "0.99". Table 2 illustrates the minimum sample size calculation carried out by

Warp PLS with the two different mathematical methods.

Table 2: Sample Size according to Warp PLS

Calculation Method	Min	Max
Inverse Square Root	278	279
Gamma Exponential	260	261

3.2 Survey Instrument

Dillman (2011) identified three main types of questions or variables, including 1) opinion questions that represent the respondents' attitudes toward a specific topic, situation, or issue, 2) the behaviour variables that interconnect the behavioural patterns of the respondents with their timeline, and 3) the type, which is the attribute variables that are meant to discover the unknown information about the characteristics of the respondents, for example, age, gender, and education. According to Dillman (2011), the distinction of all the measurement items of the developed questionnaire to measure constructs is opinion variables.

3.3 Measurement of Influencing Variables

Table 2 presents the items for the constructs of Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Hedonic Motivation (HM), and Habit (HB).

Table 3: The measurement Items of Performance Expectancy

Construct	Code	Measurement Items	Adapted from
Performance Expectancy (PE)	PU-1	1) I feel that using tablets is useful to me.	[46,47]
	PU-2	2) Using tablets improves my efficiency.	
	PU-3	3) Using tablets improves my convenience.	
	PU-4	4) Using tablets improves my study quality.	
Effort Expectancy (EE)	EE-1	1) Skillfully using tablets is easy for me.	[46,47]
	EE-2	2) I find that using tablets is simple for me.	
	EE-3	3) Learning how to use tablets is easy for me.	
	EE-4	4) My interaction with tablets is easy and simple.	
Social Influence (SI)	SI-1	1) My parents think that I should use Tablet to learn	[46,47]
	SI-2	2) All my friends think that I should use Tablet to learn	
	SI-3	3) all my colleagues love to use tablets for learning.	
Facilitating Condition (FC)	FC-1	1) I have the resources necessary to use tablets in my study.	[46,47]
	FC-2	2) I have the necessary knowledge for using tablets in my study.	
	FC-3	3) I can use the Tablet with all materials I study.	
	FC-4	4) A specific person (or group) at my school is available for assistance with difficulties in using the Tablet.	
Hedonic Motivation (HM)	HM-1	1) I have fun when I use the Tablet.	[46,47]
	HM-2	2) I enjoy using the Tablet in my study.	
	HM-3	3) Tablets are entertaining to use in my studies.	
Habit (HB)	HB-1	1) The use of Tablets has become my habit.	[46,47]
	HB-2	2) I am addicted to using Tablets.	
	HB-3	3) I must use Tablets.	
	HB-4	4) Using tablets has become natural to me.	
Task Characteristics (Tsk-C)	TC-1	1) I need to use Tablets to manage my homework.	[48]
	TC-2	2) I need to use Tablets to enhance my classwork.	
	TC-3	3) I need to use Tablets to do all my studies choirs.	
	TC-4	4) I need to use Tablets to provide effective services to others.	
	TC-5	5) Tablets help me exchange and to share information with other students effectively.	
	TC-6	6) I need to use Tablets in the classroom and at home.	
	TkC-1	1) The functions of Tablets provide good services for me.	[48]

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Construct	Code	Measurement Items	Adapted from
Technology Characteristics (Tech-C)	TkC-2	2) The functions of Tablets provide instant services for me.	
	TkC-3	3) The functions of Tablets protect my learning data.	
	TkC-4	4) The functions of Tablets provide quick service.	
	TkC-5	5) The functions of Tablets are easily accessible at any time required for me	
Task Technology Fit (TTF)	TTF-1	1) In helping complete my tasks, the functions of Tablets are enough.	[48]
	TTF -2	2) The functions of Tablets are appropriate to complete my tasks.	
	TTF -3	3) In general, the functions of Tablets fully meet my needs.	
	TTF -4	4) The functions of Tablets provide optimum service for me.	
	TTF -5	5) In general, real-time Tablets are appropriate for me.	
Intention to use Tablets (ITU)	InU-1	1) I prefer to continue to use Tablets than any alternative manual ways.	[46,47]
	InU -2	2) I intend to continue using Tablets in the future.	
	InU -3	3) I would use Tablets rather than any other means available.	
	InU -4	4) I intend to continue using Tablets more frequently.	
	InU -5	5) I am excited about using Tablets.	

3.4 Measurement of Tablet Use Variable

Table 3 presents the measurement of the mediating variable, which is the use of tablet devices in the teaching process of primary schools in Saudi Arabia. This variable mediated the relationship between the factors selected from the UTAUT theory and students' engagement in the educational process in Saudi primary schools, as well as the measurement of the dependent variable of this study, i.e., the student engagement in the educational process, which is affected by the mediating variable directly, and indirectly affected by the factors of using tablets.

Table 4: The measurement Items of Tablet Actual Use

Construct	Code	Measurement Items	Adapted from
Tablet Use (TA)	TA-1	1) I often use Tablet PCs during classes.	[47]
	TA-2	2) I often use Tablets to do assignment	
	TA-3	3) I often use Tablets to communicate and interact.	
	TA-4	4) My interaction with Tablets is clear and understandable.	

3.5 Measurement of Student Engagement "DV"

The measurement of the dependent variable, student engagement in the educational process of primary schools in Saudi Arabia, is illustrated in Table 4. It is affected by the mediating variable directly and indirectly affected by the factors of using tablet devices.

Table 5: The measurement Items of Students' Engagement

Construct	Code	Measurement Items	Adapted from
Student Engagement (SE)	SE-1	1) Using Tablets supports my engagement during class.	[33,49]
	SE-2	2) Using Tablets enhances my engagement via communication with the teacher.	
	SE-3	3) Using Tablets helps me engage with my assignments.	
	SE-4	4) Using Tablets enhances my engagement via communication with my friends.	
	SE-5	5) Using Tablets would increase my attention during class.	
	SE-6	6) Using Tablets encourages me to study more in school.	

SE-7 7) Using Tablets encourages me to study more at home.

4. RESULTS ANALYSIS

4.1 Respondents' Profile

The first section of the survey investigates the respondents' demographic information to identify the differences between male and female students, as displayed in Table 5. The results showed that around 45% of the respondents were males, whereas the other 54% were females. Regarding the education level, the sample included 4th-grade students (29%), 5th-grade students (39%), and 6th-grade students (32%).

Table 6: Personal characteristics with respondents' count and percentage

Respondents' Profile	Frequency (n=279)	Percentage (%)
Gender		
· Male	126	45.2%
· Female	153	54.8%
Education		
· 4th Grade	81	29.0%
· 5th Grade	108	38.7%
· 6th Grade	90	32.3%

4.2 Descriptive Analysis

Several statistical analysis techniques, typically including Relative Importance Index analysis (RII) and comparison of the means with the average value of all mean values, were used to rank the items of the variables that influence the students' engagement. The respondents' perceptions about the affecting factors are illustrated in Table 6. The highest mean values were for the items associated with hedonic motivation (HM), whereas the mean value of the performance expectancy ranged from (6.55 to 6.74).

Table 7: The results of descriptive analysis of independent variables

Construct /Average	Item	Mean	RII	Std. Deviation
Performance Expectancy (PE) 4.51	PU-1	4.80	0.69	1.94
	PU-2	4.57	0.65	1.86
	PU-3	4.46	0.64	2.19
	PU-4	4.20	0.60	2.12
Effort Expectancy (EE) 4.39	EE-1	4.61	0.66	1.99
	EE-2	4.47	0.64	1.96
	EE-3	4.17	0.60	2.01
	EE-4	4.31	0.62	2.01
Social Influence (SI) 3.74	SI-1	4.15	0.59	2.05
	SI-2	3.57	0.51	1.89
	SI-3	3.49	0.50	1.85
	FC-1	4.21	0.60	2.20
Facilitating Condition (FC) 4.04	FC-2	4.32	0.62	2.09
	FC-3	4.15	0.59	2.12
	FC-4	3.47	0.50	2.07
Hedonic Motivation (HM) 4.31	HM-1	4.47	0.64	1.74
	HM-2	4.25	0.61	1.81
	HM-3	4.20	0.60	1.91
Habit (HB) 4.21	HB-1	4.24	0.61	2.13
	HB-2	4.47	0.64	2.18
	HB-3	4.00	0.57	2.12
	HB-4	4.15	0.59	2.01
Task Characteristics (Tsk-C) 3.89	TC-1	4.05	0.58	2.29
	TC-2	4.12	0.59	2.11
	TC-3	3.57	0.51	2.20
	TC-4	3.83	0.55	2.11
	TC-5	4.14	0.59	2.10
	TC-6	3.66	0.52	2.19
Technology Characteristics (Tech-C) 4.30	TkC-1	4.31	0.62	2.13
	TkC-2	4.31	0.62	2.02
	TkC-3	4.20	0.60	2.12
	TkC-4	4.23	0.60	2.13
	TkC-5	4.47	0.64	2.17

The descriptive analysis elaborates on the level of understanding and awareness of the perceived status of the factors affecting the students' engagement in the learning process in the selected Saudi primary schools.

Table 8: The results of descriptive analysis of mediating and dependent variables

Construct /Average	Item	Mean	RII	Std. Deviation
Task Technology Fit (TTF) 4.67	TTF-1	4.15	0.59	2.44
	TTF -2	4.53	0.65	1.87
	TTF -3	5.30	0.76	1.53
	TTF -4	4.43	0.63	2.16
	TTF -5	4.93	0.70	1.70
Intention to Use Tablets (ITU) 5.30	InU-1	4.81	0.69	1.93
	InU -2	5.54	0.79	1.46
	InU -3	5.74	0.82	1.40
	InU -4	5.33	0.76	1.58
	InU -5	5.07	0.72	1.61
Tablet Actual Use 4.92	TA-1	4.90	0.70	1.74
	TA-2	4.96	0.71	1.68
	TA-3	4.84	0.69	1.72
	TA-4	5.00	0.71	1.65
Student Engagement	SE-1	4.59	0.66	1.38
	SE-2	4.27	0.61	1.52

(SE) 4.43	SE-3	4.24	0.61	1.83
	SE-4	4.25	0.61	1.52
	SE-5	4.36	0.62	1.53
	SE-6	4.51	0.64	1.65
	SE-7	4.79	0.68	1.34

To sort the affecting factors according to strength from the respondents' perceptions, the average of RII of the items of each construct was compared to relatively sort them. Table 8 illustrates the sorted affecting factors. According to the average of the RII and the means of the construct's items, the strongest weight was for the mediator of intention to use Tablet PCs, whereas the highest weight of the IVs was for the performance expectancy and the smallest weight was for the social influence construct as an independent variable.

Table 9: Sorting affecting factors according to RII and mean average.

Order	Construct	RII average	Mean average
1	Intention to Use Tablets (ITU)	0.76	5.30
2	Student Engagement (SE)	0.70	4.92
3	Task Technology Fit (TTF)	0.67	4.67
4	Performance Expectancy (PE)	0.64	4.51
5	Tablet Actual Usage	0.63	4.43
6	Effort Expectancy (EE)	0.63	4.39
7	Hedonic Motivation (HM)	0.62	4.31
8	Task Characteristics (Tsk-C)	0.61	4.30
9	Habit (HB)	0.60	4.21
10	Facilitating Condition (FC)	0.58	4.04
11	Technology Characteristics (Tech-C)	0.56	3.89
12	Social influence (SI)	0.53	3.74

4.3 Assessment of Model Using PLS-SEM

To assess the model using PLS-SEM analysis, a two-step process should be followed, including the assessment of the measurement model and the assessment of the structural model [50,51]. In the assessment of the measurement model, the validity and reliability of the relationships between the latent variables (LV) and the associated observable variables should be examined, whereas in the assessment of the structural model, the relationships between constructs should be considered [50,51]. This study used the Warp PLS 7.0 statistical software to analyse the models. Warp PLS 7.0 was mainly used to analyse the non-linear conceptual framework and the power and capacity of Warp PLS to assess the measurements and the structural model's essential criteria.

4.3.1 Assessment of Measurement Model

Formative and reflective models are two different types of measurement models (the outer model) used in the analysis process, and different methods and criteria are required to assess their respective quality [50,51]. A total of 12 constructs/variables - all of them are formed of reflective items. To assess the measurement model of the formative constructs, the default settings should be adjusted to suit the type of data in this study as 1) the outer model analysis algorithm; according to Kock (2017), if the constructs are formative, Mode A should be selected, 2) the default inner model "Warp3" was selected, 3) the Re-sampling method is "Stable1" (Kock, 2017c). The following four values should be calculated and reported, including 1) the outer loading of the items should be more than 0.7, 2) CR Composite Reliability, 3) the most common Cronbach's Alpha [50,51], and 4) the collinearity between the constructs [53], and the average variance should be extracted (AVE).

4.3.2 Reliability

To evaluate the reliability of the reflective measurement model for SEM, the tests of indicator reliability and construct reliability should be conducted accordingly. To assess indicator reliability, the loading of each indicator on its associated latent construct should be checked. To obtain acceptable indicator reliability, this loading should be higher than 0.7 [51,54,55]. Table 9 indicates that the loadings of COM-1, PA-2, and ERI-1 are lower than 0.7 at 0.352, -0.092, and 0.387, respectively; therefore, they were removed. The loadings of other indicators are higher than 0.7. The loading between 0.4 and 0.7 should be removed if the deletion increases the composite reliability or validity [51].

Furthermore, to assess construct reliability, two coefficients are typically considered: CR and the more common coefficient Cronbach's alpha [55–57]. However, CR is more suitable for PLS-SEM [51]. The CR and Cronbach's alpha for all first-order latent variables in the measurement model reached over 0.8. Therefore, the results showed that the measurement model has internal consistency and is reliable.

Table 10: Results of the assessment of the measurement model for the constructs

Construct	CR Composite Reliability	Cronbach's Alpha	AVE	Full Collinearity
Performance Expectancy (PE)	0.894	0.842	0.678	3.136
Effort Expectancy (EE)	0.923	0.887	0.751	2.770
Social influence (SI)	0.910	0.863	0.771	5.016
Facilitating Condition (FC)	0.914	0.876	0.729	6.121
Hedonic Motivation (HM)	0.883	0.803	0.717	1.559
Habit (HB)	0.824	0.728	0.541	1.314
Task Characteristics (Tsk-C)	0.840	0.838	0.492	1.268
Technology Characteristics (Tech-C)	0.032	0.739	0.168	1.140
Task Technology Fit (TTF)	0.682	0.494	0.413	5.435
Intention to Use Tablets (ITU)	0.877	0.821	0.592	4.616
Tablet Actual Usage (Act)	0.858	0.778	0.606	3.801
Student Engagement (SE)	0.843	0.780	0.466	3.388

The variables formed a relationship between the affecting factors and the dependent variable of students' engagement, wherein the five (8) affecting factors acted as independent variables (IVs), whereas students' engagement represents the dependent variable (DV).

4.3.3 Discriminant Validity

The following assessment within the measurement model evaluation is discriminant validity. It is identified as the extent to which a construct is conceptually distinct or differs from other measured latent variables in a study [58]. As mentioned earlier, there are three indicators to measure such assessment; however, this study will only discuss discriminant validity assessment using Heterotrait-Monotrait Ratio (HTMT) indicator rather than the other two measures.

Looking at all endogenous and exogenous constructs in this study, the obtained HTMT ratio is lower than the 0.95 threshold value. This signifies that each construct is unique and distinct from other constructs in this study and has adequate discriminant validity to be based on [58,59]. Table 10 shows each construct's HTMT value against other constructs in this study, whereby the highest value of 0.924 appeared to be between two constructs of ERI and Organizational culture. This result, however, indicated a specific measure between these two constructs and satisfied adequate discriminant validity with a score below the 0.95 thresholds.

Table 11: Heterotrait-Monotrait Ratio (HTMT0.85) Assessment

	PE	EE	SI	FC	HM	HB	Task-C	Tech-C	TTF	ITU	Act	SE
Performance Expectancy (PE)												
Effort Expectancy (EE)	0.823											
Social influence (SI)	0.722	0.708										
Facilitating Condition (FC)	0.832	0.807	1.015									
Hedonic Motivation (HM)	0.331	0.299	0.275	0.314								
Habit (HB)	0.091	0.094	0.102	0.083	0.296							
Task Characteristics (Tsk-C)	0.040	0.108	0.106	0.085	0.289	0.445						
Technology Characteristics (Tech-C)	0.106	0.133	0.068	0.104	0.303	1.027	0.407					

Task Technology Fit (TTF)	0.636	0.789	0.556	0.628	0.519	0.353	0.264	0.240				
Intention to Use Tablets (ITU)	0.563	0.497	0.230	0.380	0.439	0.191	0.155	0.122	1.156			
Tablet Actual Usage (Act)	0.642	0.636	0.490	0.576	0.342	0.089	0.109	0.107	1.122	0.911		
Student Engagement (SE)	0.347	0.253	0.181	0.305	0.713	0.399	0.473	0.327	0.953	0.837	0.758	

4.3.4 Direct Effect

The direct effect in SEM path analysis refers to the direct relationship between exogenous and endogenous constructs or variables in a typical PLS path hypothesised model. According to Hair (1998), SEM analysis predicts the effect of the relationship for a hypothesised research framework or model. This approach is mainly applied to test the hypothesised research model and the relationship or effects of the relationship amongst the constructs through direct effects. According to Duarte and Raposo (2010), two major approaches are used to measure the structural model, namely:

(i) The descriptive power of the model (i.e., R 2 coefficients of the determination), which examines the degree of variance of an endogenous variable as explained by its predictor variable.
(ii) The value and significance of the path coefficient of the model involve the estimated path relationships with the standard betas in the regression analysis.

Table 12: Results of hypothesis testing.

Hypothesis		Path Coeff.	P Value	Effect Size	Result
H1	Performance Expectancy (PE) > Intention to Use Tablets (ITU)	0.358	<0.001	0.200	Supported **
H2	Effort Expectancy (EE) > Intention to Use Tablets (ITU)	0.147	0.002	0.076	Supported *
H3	Social influence (SI) > Intention to Use Tablets (ITU)	0.167	<0.001	0.056	Supported **
H4	Facilitating Condition (FC) > Intention to Use Tablets (ITU)	0.136	0.004	0.062	Supported *
H5	Hedonic Motivation (HM) > (ITU) Intention to Use Tablets (ITU)	0.108	0.017	0.050	Supported *
H6	Task Characteristics (Tsk-C) > Task Technology Fit (TTF)	-0.097	0.028	0.030	Supported *
H7	Technology Characteristics (Tech-C) > Task Technology Fit (TTF)	-0.437	<0.001	0.203	Supported **
H8	Task Technology Fit (TTF) > Tablet Actual Usage (Act)	0.179	<0.001	0.044	Supported **
H9	Intention to Use Tablets (ITU) > Tablet Actual Usage (Act)	0.604	<0.001	0.500	Supported **
H10	Tablet Actual Usage (Act) > Student Engagement (SE)	0.272	<0.001	0.209	Supported **
H11	Performance Expectancy (PE) > Intention to Use Tablets (ITU)	0.795	<0.001	0.632	Supported **

The level of significance: ** <0.01, * <0.05.

In this study, all the R^2 values were higher than the threshold of 0.24, and these values are accepted by consumer behavior research standards [52]. Regarding the path coefficient and the P values, Table 11 shows high P values, which are more than the accepted threshold of 0.05, resulting in insignificant Path Coefficient values, thereby rejecting some of the hypotheses proposed by this study.

5. RESULTS DISCUSSION

This study mainly aims to develop a model that identifies the affecting factors of student engagement in the learning process via tablet devices through the adoption of the UAUT and TTF theories. This study examines the factors that directly affect the adoption and use of Tablet PCs and indirectly on students' engagement as a dependent variable. The effect size values of the relationships were calculated to determine the strength of each factor on the variable of actual use of Tablet PCs. By interpreting the statistics of the causal effect between the variables, all the selected independent variables were found to affect the use of Tablet PCs except for the direct

effect of Habit on intention to use Tablets was rejected because it was not significant.

Table 12 illustrates the significant factors and their effect on student engagement with the path coefficient path values with the corresponding P values to show the significance of the relationships with the direction of the effect as well as the effect size values to order the significant barriers according to their relationship's strength. Figure 1 shows the final amended model that defines the relationship between the factors' effect on student engagement with the relationship lines weighted according to the relationship strength with the path coefficient values on the relative relationships.

Table 13: Significant factors' effect on student engagement.

Hypothesis		Path Coeff.	P Value	Effect Size	Result
H1	Performance Expectancy (PE) > Intention to Use Tablets (ITU)	0.131	0.005	0.123	Supported **
H2	Effort Expectancy (EE) > Intention to Use Tablets (ITU)	0.083	0.050	0.072	Supported *
H3	Social influence (SI) > Intention to Use Tablets (ITU)	-0.124	0.008	0.118	Supported **
H4	Facilitating Condition (FC) > Intention to Use Tablets (ITU)	0.814	<0.001	0.791	Supported **
H5	Hedonic Motivation (HM) > (ITU) Intention to Use Tablets (ITU)	0.100	0.025	0.094	Supported *
H7	Task Characteristics (Tsk-C) > Task Technology Fit (TTF)	0.536	<0.001	0.514	Supported **
H8	Technology Characteristics (Tech-C) > Task Technology Fit (TTF)	0.448	<0.001	0.427	Supported **
H9	Task Technology Fit (TTF) > Tablet Actual Usage (Act)	0.557	<0.001	0.354	Supported **
H10	Intention to Use Tablets (ITU) > Tablet Actual Usage (Act)	0.103	0.021	0.055	Supported *
H11	Tablet Actual Usage (Act) > Student Engagement (SE)	0.885	<0.001	0.783	Supported **

P<0.05

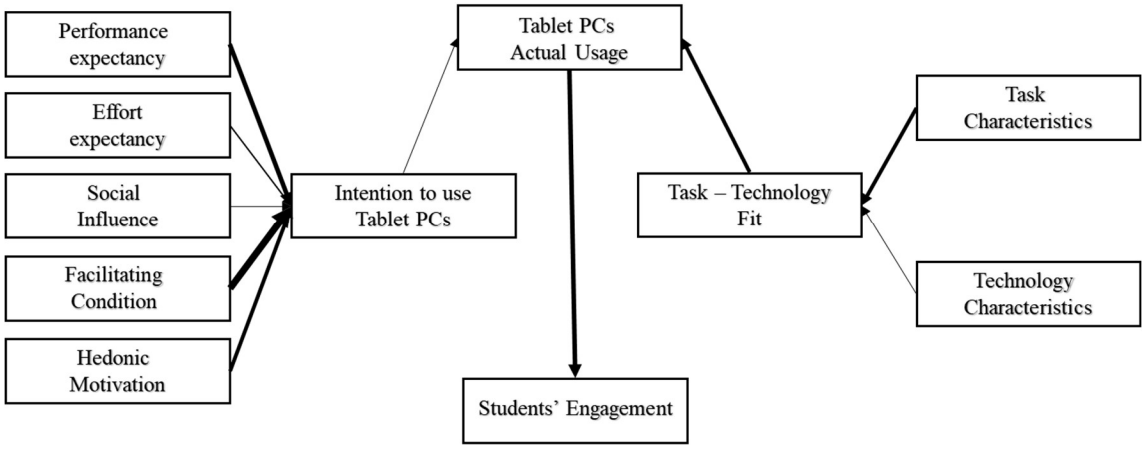

Figure 2: Factors' direct relationship visualized by weight.

The facilitating condition factor was found to be the most decisive factor affecting the intention to use tablet computers, with an effect size (ES) of 0.791. The positive path coefficient value indicates that the implementation of this factor increases the likelihood that students will use tablet computers, thus supporting hypothesis H4. This finding is consistent with previous literature, which has shown that facilitating conditions have a positive effect on technology adoption and engagement among students [61–63].

In contrast, the performance expectancy factor had a noticeably smaller effect size on the intention to use tablet computers (ES = 0.123) compared to the facilitating condition factor. Nonetheless, the positive path coefficient value supports hypothesis H1, indicating that the implementation of this factor increases the likelihood of tablet computer adoption among students. This result is in line with previous studies that have found a positive effect of performance expectancy on the use of tablet

computers and student engagement [62,64,65], although some researchers have reported conflicting results [66,67]. There are several potential reasons behind the conflicting findings related to the effect of performance expectancy on the intention to use tablet computers. Firstly, the differing study contexts may have led to differences in the perceptions of performance expectancy among students. For example, the perceived benefits of using tablet computers may differ between students in different disciplines or with different levels of prior experience using technology.

Similarly, the social influence factor had a comparable effect size on the intention to use tablet computers (ES = 0.118) to that of the performance expectancy factor. The positive path coefficient value supports hypothesis H3, indicating that the implementation of this factor increases the likelihood of student adoption of tablet computers. This result is consistent with several studies that have found a positive effect of social influence on the use of tablet computers and student engagement [61,63,65,68], although conflicting results have also been reported by other researchers [69–71]. There could be several potential reasons behind the conflict in findings for the social influence factor's effect on the intention to use tablet computers. One possible reason is the differences in the educational context and the specific tablet technology being used. The influence of social factors may vary depending on factors such as the type of course, level of study, and cultural context.

The effect size of the hedonic motivation factor on the intention to use tablet computers was the smallest (ES = 0.099). Nevertheless, the positive path coefficient value supports hypothesis H5, indicating that implementing this factor increases the likelihood of student adoption of tablet computers. This finding aligns with previous research that has reported a positive effect of hedonic motivation on the intention to use tablet computers and student engagement [65,72–74]. However, there are also conflicting results [75–77]. Several reasons may account for these inconsistencies, including variations in the definitions and measurements of hedonic motivation, differences in sample characteristics and contextual factors, and disparities in research methods, such as sample size, data collection instruments, and statistical techniques used.

In summary, the study suggests that when designing interventions to promote tablet computer adoption among students, it is essential to consider facilitating conditions, performance expectancy, social influence, and hedonic motivation factors.

6. CONCLUSION

This paper investigated the main factors affecting the utilization of tablets in the learning process among students at Saudi primary schools. The study has also investigated the significant relationship between using tablet factors in the education process and the level of primary school students' engagement in the learning process. the factors were sorted according to their RII and Mean values using the descriptive analysis. This study used Warp PLS 7.0 to implement the SEM-PLS statistical approach to assess the measurement model, which resulted in a high consistency between the indicators and constructs of the study. The structural model was also assessed and proved empirically all the proposed hypotheses except for the insignificant direct effect of the habit factor on the intention to use tablets, which was rejected. In conclusion, this study contributed to the theoretical advancements in the existing literature on the education sector performance enhancement by identifying the most critical human resource management strategies that significantly impact students' engagement. This will be accomplished by empirically proposing and testing a conceptual framework for the engagement factors implemented in Saudi primary schools from the students' and teachers' perspectives, demonstrating the relationship between the selected factors and the student's engagement in the learning process. Further studies are recommended to identify the moderation effect of other major moderating groups on this relationship between the studied factors and students' engagement, for example, the students' study course and age or gender and the study phase. These are major moderating variables used by many researchers in education fields, and the behaviour would expectedly vary between different types of students due to the differences in experiences, specialties, knowledge areas, and courses.

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