

# Feasibility Study of Tablet PC Acceptance Among School Children in Malaysia

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## Graphical abstract



## Abstract

Nowadays the use of Tablet Personal Computer (TPC) as a medium of imparting education is gaining popularity among students and teachers. However, limited studies on school children have been conducted on their acceptance of Tablet PCs. Therefore, technology acceptance of TPC by 8<sup>th</sup> grade school children in Malaysia was studied in this research. The various benefits and current research pattern of TPC in education is described. Then, a mixed mode (quantitative and qualitative) study using the Technology Acceptance Model (TAM) and informal conversational interviews was done to analyse the acceptance and usage of TPC among school children at a private school in Malaysia. The results of this study show that only 46% of the 8<sup>th</sup> grade students intend to use Tablet PC in the future. The results from this feasibility analyses are discussed and a future research is suggested.

*Keywords:* Tablet personal computer; technology acceptance model; school children

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## 1.0 INTRODUCTION

Application of technology in the field of education has expanded significantly. Technologies like Smart Whiteboards, Tablet PCs (TPCs) and e-books are being used prevalently.

A shift from the traditional way of teaching and learning to a more adaptive and personalized learning has been noticed. The shift is being greatly assisted by Information Communication Technologies (ICT) and Tablet PC (TPC) which have helped in making classrooms more interactive and personalized for students and hence increase their interest in learning. The aforementioned technologies were found to be beneficial to teachers as well [1, 2]. Using Smart Whiteboard together with TPC in a learning environment has the ability to strengthen interactive communication between teachers and students [3]. Moreover, TPC adoption in higher education helps the students in the learning process [4-8].

By placing the entire course curriculum on TPC, besides the environmental benefits, improved perceived usefulness of TPCs for students has also been noted. The course curriculum is a book-length publication in digital form, consisting of text, images, or both, and readable on TPC, Smart Phones, computers or other electronic devices.

This study has two main parts. Firstly, based on previous studies on use of TPC in education, the idea that TPC can replace

the school bag is conceived. Secondly, to verify this claim, a mixed mode study using qualitative and quantitative methods is carried out at a private school in Kuala Lumpur, Malaysia where TPCs are being used.

## 2.0 BACKGROUND OF RESEARCH

### 2.1 Tablet PC: The Virtual School Bag

With the advent of Tablet PCs in the mid-2000s their sale and usage has been increasing rapidly. It has also been predicted that within few years it would overtake the desktop pc market [9]. The usage of computers in education has shown many advantages. Since TPCs and other forms of mobile computers are being predicted to become more widely used in the future, it becomes logical to study their impact in imparting education.

TPCs have been found to have many advantages over traditional pen and paper based classrooms. They are portable and can be easily used to take down notes which can be shared then and there with others if required [9, 10]. Teaching can be made more immersive and interesting with them as they can be used for a wide variety for audio-visual learning materials [8]. Use of TPC during a lecture helps both the teacher and students as the students can follow the slides on their personal TPCs and take notes

therein. They don't have to wait after class for the teacher to email the slides. Using a digital pen with a TPC a teacher can make lectures more interactive and students can instantaneously have the annotated copies of the slides on their personal TPCs [11, 12]. Wi-Fi enabled TPCs as well make the classroom more interactive as students can search the web to get information they require in activities like group work [13]. With the use of TPC, conventional books can be easily replaced with e-books hence giving the ability to carry a large number of books in a small portable device.

Some scholars have showed the importance of TPC and they stated that it could replace the physical school bag and hence called the TPC as an E-Bag. Brodersen *et al.* in their work defined the E-Bag as a digital depot in which the user can store pictures, songs, e-books, video and other digital materials [14]. Research works have described the many advantages of E-Bag and also have stressed on the fact that it is also less burdensome on school children than physical school bags [14, 15].

From the aforementioned discussions, it can be clearly understood that TPCs are light portable devices that can be used as textbooks as well as notebooks and also have a range of other features that promote learning. From the previous studies it can be concluded that E-Bag is nothing but a TPC containing all the learning materials such as e-books, calculator and multimedia material that a student requires at school. The concept of E-Bag is represented pictographically in Figure 1.

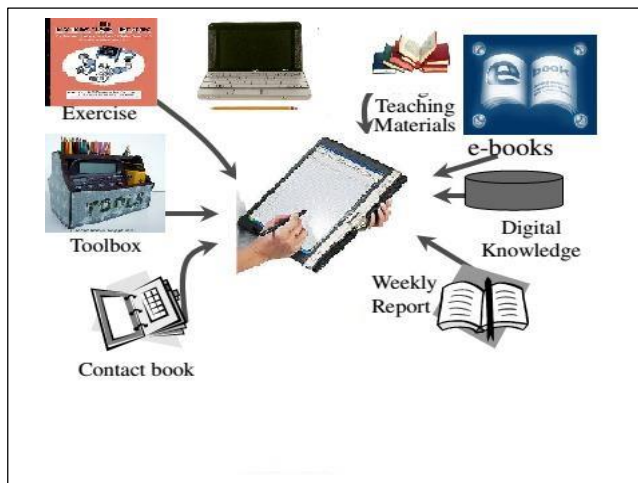


Figure 1 Tablet PC as E-Bag

## 2.2 Related Research Work

Researchers have studied the use of TPC in university classrooms. According to many studies TPC has been found to have a very positive impact on teaching and learning, for example using interactive multimedia in classrooms, for annotations and easy search and using stylus for engineering courses [6, 8, 16-18].

Growing advantages of TPC give more chances to researchers to observe its use. However, very few studies have analyzed the importance of TPC in the classroom for school children, as most of the studies have been on university students. An observation of TPC usage in elementary school reported improved teaching, playing and learning as some of the benefits [19]. Children can draw by using stylus pen easily. In spite of facing technological issues, the children were very interested in using TPC and they preferred using TPC over the traditional methods [20]. TPC has shown to be a feasible tool for providing young children a medium of representing their ideas in the early-

childhood classroom. The children easily became comfortable with using the stylus and ink features of the TPC [20].

Technology acceptance studies are common way of determining future use in Information Systems and related areas. Many technology acceptance studies have been carried out to observe the usage of TPCs in an educational setup. Most of these have shown that students do intend to use TPC in their classes and have a positive attitude towards it. However, most of these studies have also been on university level students. The commonly used acceptance model is Technology Acceptance Model (TAM) however some researchers have extended it with constructs from other popular models like Unified Theory of Acceptance and Use of Technology (UTAUT) [9, 21, 22].

In the above sections the various research works on TPC were discussed. From the above discussions the lack of research works on the acceptance and use of TPC at school level can be observed.

Therefore, in this research the acceptance of TPC from the perspective of school children has been studied.

## 3.0 RESEARCH MODEL AND HYPOTHESIS

For quantitative analysis, TAM was used to check acceptance of TPC. TAM is one of the most popular technology acceptance model formulated by Davis in 1989. In this theory two new constructs Perceived Ease Of Use (PEOU) and Perceived Usefulness (PU) were introduced and added to Fishbein and Ajzen's Theory of Reasoned Action (TRA) [23]. Davis defined PU as "the degree up to which a person believes that using a particular system would enhance his or her job performance" and PEOU was defined as "the degree up to which a person believes that using a particular system would be free of effort". Behavioral Intention (BI) was defined as "The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior" [24]. The research model can be seen in Figure 2.

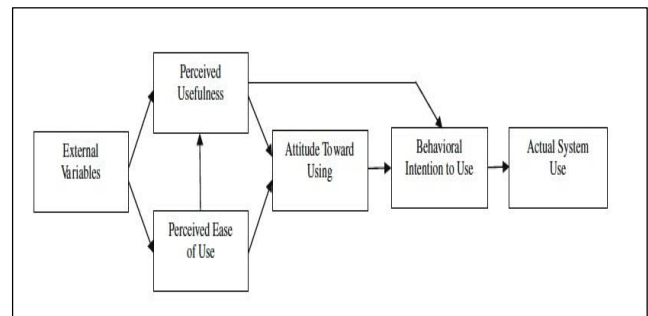


Figure 2 Technology acceptance model

Nevertheless, the construct 'Attitude' in TAM has frequently been dropped by researchers as it has been found to be insufficient in predicting Behavioral Intention [25], so in this study also it has not been used.

In TAM the following relationships have been studied and found to be significant [24] –

- Between Perceived Usefulness (PU) and Behavioral Intention (BI)
- Perceived Ease Of Use (PEOU) and Perceived Usefulness (PU).

Additionally these relationships have successfully been verified in other acceptance studies done in education domain,

e.g. [25–27]. Hence based on the above paragraphs the following hypothesis is formulated.

- H1: PU will have a significant positive impact on BI for using TPC  
 H2: PEOU will have a significant positive impact on PU of TPC

In the original TAM the effect of PEOU on BI is tested through intermediary construct ‘Attitude’ as can be seen in Figure 2. However, since Attitude is not being used in this study, hence the effect of PEOU on BI was tested directly. Other researchers have also tested this relationship in acceptance studies done in education area, e.g. [25, 28]. There the following is hypothesized.

- H3: PEOU will have a significant positive impact on BI for using TPC

The above discussed hypotheses are represented in the structural model shown in Figure 3. Each construct and their corresponding items are also represented in the model. PU and PEOU have four items each and BI has two items.

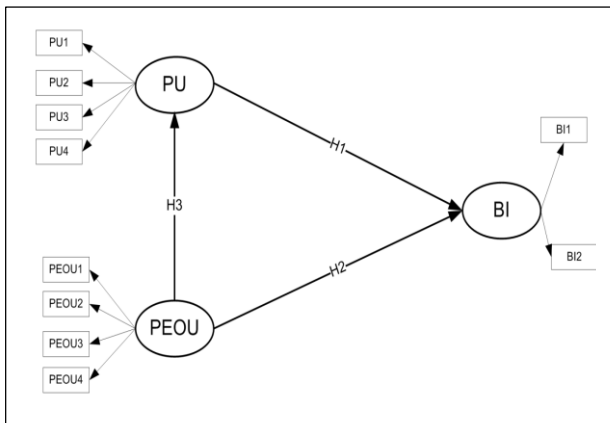


Figure 3 Research model

## 4.0 METHODOLOGY

In this research both qualitative and quantitative methods have been used so as to get a better and well-rounded opinion on the usage and acceptance TPC by school children.

### 4.1 Qualitative Approach

Informal conversational interviews were carried out after the survey was completed by the participants. This form of interview was considered correct as it is more adaptable as per the interviewee’s priorities [29]. The important excerpts from the interviews have been presented in the results section of this paper.

### 4.2 Quantitative Approach

The methodology for the quantitative approach is described in the following sub-sections.

#### 4.2.1 Participants

This study was conducted at a private school in Kuala Lumpur, Malaysia. The participants were 8<sup>th</sup> grade students. They had been using TPC since 7<sup>th</sup> grade, so all of them had minimum one year

of experience in using TPC for educational purposes. A total of 22 students were given the questionnaire and all of them returned the completed questionnaire.

#### 4.2.2 Research Instrument

The research questions were adopted from the work of previous researchers that studied TAM relationships [27, 28]. A 5 point Likert scale was used for all the items in the questionnaire. The questionnaire also collected demographic information pertaining to age and sex.

The Perceived Ease of Use (PEOU) construct had four questions/items. This construct checked how easy it was for the students to use TPC. For example, one of the construct items stated “I find completing my desired tasks on Tablet PC easy to do”. The Perceived Usefulness (PU) construct tried to check how useful the students felt the TPC was for their education. This construct also had four items. For example, one of the construct items was “Using Tablet PC improves my learning performance”. The third construct Behavioural Intention (BI) had two items. It checks if the students would like to use TPC in the future. For example, one item was “I plan to use Tablet PC for learning in the future”.

#### 4.2.3 Data Collection

Paper based survey questionnaires were used to collect the data.

#### 4.2.4 Data Analysis

Partial Least Square (PLS)-Structure Equation Modelling (SEM) was used to analyse the data. The reasoning behind the selection of this method is based on the rule of thumb by Hair *et al.* and Chin [30, 31] which states that PLS-SEM should be selected in case of exploratory research, this research being a type of exploratory study. In addition, if the sample size is a constraint then PLS-SEM would be appropriate, as in this research the sample size is only 22 participants.

The sample size was also calculated based on the rule of thumb by Hair *et al.* and Chin which states that the sample size should be larger of the two conditions [30, 31]:

1. 10 times largest number of formative indicators or
2. 10 times largest number of independent variables determining a dependent variable

In this study since there is no formative construct hence rule number 2 is valid. In the research model of this study both PU and PEOU are affecting the variable BI. Hence as per rule 2 the minimum required sample size is 20. The sample size used is 22 which is slightly above the minimum requirement. Previous research with very small size has also been done [32, 33].

## 5.0 RESULTS

### 5.1 Quantitative Approach

#### 5.1.1 Participant Characteristics

From Table 1 it can be observed that the majority of the respondents were from the age group 13-16. In addition, it can be seen that the majority of the respondents were females.

**Table 1** Respondent age and gender

| Demography       | Number of respondents | Percentage |
|------------------|-----------------------|------------|
| <b>Age group</b> |                       |            |
| 10-13            | 6                     | 27.27      |
| 13-16            | 16                    | 72.72      |
| <b>Sex</b>       |                       |            |
| Female           | 13                    | 59.09      |
| Male             | 9                     | 40.90      |

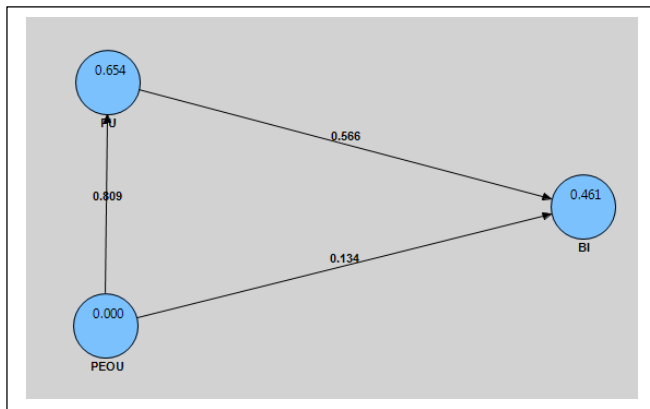
### 5.1.2 Research Model Evaluation

Internal consistency is measured to indicate the reliability of the items in a construct. While using PLS-SEM Composite Reliability is considered a better measure of internal consistency than Cronbach's Alpha. This is so because studies have shown that in PLS-SEM Cronbach's Alpha can be overestimated or underestimated [31, 34]. For exploratory research a value of 0.6 and 0.7 otherwise are considered good values [30, 31]. From Table 2 it can be observed that the values for Composite Reliability are above 0.6 or 0.7.

**Table 2** Composite reliability

| Construct | Composite Reliability |
|-----------|-----------------------|
| PU        | 0.8770                |
| PEOU      | 0.8075                |
| BI        | 0.9871                |

The Goodness Of Fit (GOF) in PLS-SEM measured by  $R^2$ . It is only calculated for dependent variables [35, 36]. In Figure 4 the research model after PLS-SEM calculation can be seen. The values above the arrows are path coefficients and the values inside the constructs are  $R^2$  values. It can be observed that 65.4% PU and 46.1% BI can be explained from this model. The percentage of BI explained in this research is slightly lower than other acceptance studies on tablet PC [9, 22], this could be because of the weak relationship between PEOU and BI.

**Figure 4** Goodness of fit

From Table 3 it can be seen that all the hypotheses are supported. A bootstrap procedure was used to calculate the significance of the paths.

**Table 3** Hypotheses validation

| Hypothesis | Path      | Path Coefficient | Outcome   |
|------------|-----------|------------------|-----------|
| H1         | PU → BI   | 0.566**          | Supported |
| H2         | PEOU → BI | 0.134*           | Supported |
| H3         | PEOU → PU | 0.809**          | Supported |

\*\*p<0.01, \*p<0.1

For a better understanding of the results informal conversational interviews were also done, they are described in the next section.

### 5.2 Qualitative Approach

12 students from the class were randomly picked and interviewed after they had filled the questionnaire. Some of the questions asked were – “Do you like TPC over regular books?”, “Are you comfortable using TPC?” and “How do you think can the TPC initiative be improved?”. The important excerpts from the informal conversational interviews are quoted below. Many students commented on technical aspects of the TPCs. They are listed below.

- “Scrolling is tiresome”
- “Tablet hangs frequently”
- “It would be better if a digital pen was provided like in Samsung Galaxy Tabs”
- “It doesn't feel natural like books”
- “Quality of the Tablet PC is not good, it looks cheap”

All students in general complained about the following issues.

- TPCs were only used for reading and not writing as there was no digital pen with it.
- They couldn't take the TPCs home so they were pretty disappointed about it.
- Their eyes strained after using TPCs for long hours.

## 6.0 DISCUSSION

All the hypotheses in this research are strongly supported like other studies using TAM in education except between PEOU and BI which was found to be weakly supported in this research. PEOU explains how much at ease a person is while using a particular system; however from the qualitative analysis excerpts, a number of technical issues can be seen. The weak PEOU-BI relationship could be due to these technical issues. The small sample size for the quantitative analysis could also have affected the outcome of the analysis.

The result from the PLS-SEM analysis shows that only 46% of the students in the school have intention to use TPC in the future which goes against the findings of previous studies which had predicted that TPC was preferred by students. The interviews conducted could shed a light on the reason for this rejection of TPC by the school children. As can be deduced from the interview excerpts the TPCs provided in the school has many technical drawbacks like frequent hanging of the system or no stylus was provided. Some of the issues like ‘scrolling’, ‘eye strain’, ‘unnatural feeling while reading’ are common to all the available TPCs in the market.

## 7.0 CONCLUSION AND FUTURE STUDY

In this study previous literatures on use of TPC for education were analysed so as to identify the advantages and acceptance of TPCs.



In most of the previous studies TPCs were well received by the students and hence researcher predicted that TPC could be used to impart learning. However, in this study it was found that the students of the studied school do not prefer to use TPC.

To verify the idea of using TPC for education at schools in a developing country like Malaysia this study was carried out. The results of this study are surprisingly opposite to the findings of the other researchers. As per the PLS-SEM analysis only 46% of the 8<sup>th</sup> grade students want to use TPC. To get a better understanding of the situation and find the out the reasons for this non-acceptance, informal conversational interviews were also conducted.

The interviews revealed a number of points which could explain the low acceptance rate. Some of the points dealt with technical issues inherent to TPC technology. The interview excerpts quoted in the results section should be taken as a cue by future researchers and work should be done to remove these technical drawbacks.

The other latent reason not explicitly stated by the students can be deduced as lack of adequate support to the TPC initiative by the school authorities. This can be understood from their responses in which they said that they were not allowed to take TPC to their homes, they also complained about the quality of TPC and lack of digital pen like in other commercially available tablets. The reasons for this could be from financial restriction to other administrative reasons. This point of view should also be studied by future research work as the view point of an educational institutions administration is very important in the actual implementation and use of TPCs.

Since this is a first of a kind on school children in a developing country hence more research should be carried out, as acceptance can differ in different countries. Though small sample size has been used in previous studies in education domain, to address this limitation a mass survey of students would paint a clearer picture of TPC acceptance and use. We also recommend that a future study across different schools using TPC should be carried out in order to get a better understanding of TPC usage.

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