Extending the extended UTAUT2 in understanding e-learning acceptance for future STEM education research: A conceptual framework

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ABSTRACT – Google Classroom (GC) is one of the most popular online applications for facilitates teaching and learning nowadays. Up to date, there is insufficient studies on STEM teachers' acceptance of this facility. Hence, we suggest a conceptual framework of a modified Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model by incorporating three new constructs namely, self-efficacy (SE), trust (T) and personal innovativeness (PI) towards E-Learning acceptance in this paper. However, the approach of paper is formulated on an in-depth recent literature review derived from Scopus database.

1. INTRODUCTION

Science, Technology, Engineering, and Mathematics (STEM) education has been discussed in the United States of America since the 1990s. Ever since then, it has received continuous attention by many countries in the world including Malaysia as foundational to economic growth. Future employability requires the ability to understand scientific and mathematical principles, as well as a working knowledge of technology and engineering and problem-solving abilities. In 2017, the Malaysian Ministry of Education (MOE) took seriously the recommendations of the National Education Blueprint (PPPM) 2013-2025 by promoting students to enrol in STEM fields through the integration of STEM education in teaching and learning. E-Learning has become an instrumental way to support teaching and learning process and STEM teachers should utilise the platform to broaden STEM education's reach and deepen student's understanding. E-Learning is defined as the distribution of educational information using digitally equipped devices such as personal computers, laptops, and smartphones in order to enhance learning [1]. The traditional way of learning has changed from face-to-face teaching between teachers and students in the classroom to online learning [2]. It also includes audio, video, satellite TV, and computer-based learning, as well as local intranet or extranet and web-based learning [3].

Based on latest Scopus online search carried out on 22nd August 2021 by using Boolean "and" to conjoin the two singular words "E-Learning" and "UTAUT", number of research material published on Scopus from year 2006 to 2021. A total number of 242 materials were found on this area (Figure 1). The first article on "E-Learning" and UTAUT was published in 2006. Following, a slight interest builds on "E-Learning" and UTAUT from year 2008 to 2012 as the number of published research material increases. However, the number of published research materials increased from 7 to 15 in 2013. By 2019, a drastic rise in interest on "E-Learning" and UTAUT as published materials increases to 54. The upward trend in this study area is illustrated in Figure 1.

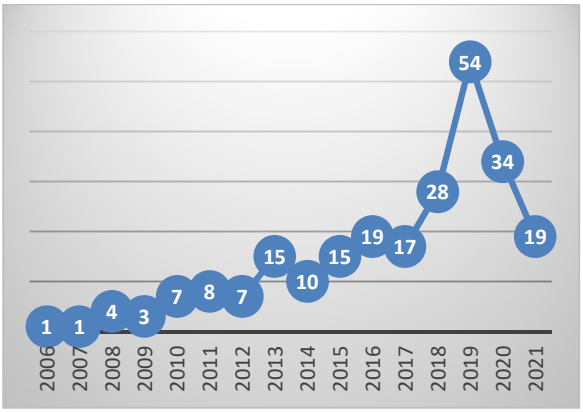

Figure 1 Number of materials published on Scopus based on "E-Learning" and "UTAUT" keywords search on Scopus.

In the literature on information systems (IS), user acceptability is critical to the success of any system. As a result, it is critical to comprehend and determine the factors that influence teachers' acceptance of E-Learning tools like Google Classroom. Buabeng-Andoh and Baah [4] and Turki and Sathiyanarayanan [8] found that Attitude plays the important effect on teachers' Behavioral Intention to use technology [4]. To add, Tseng et al. [7] also reveal that Performance Expectancy, Social Influence, Facilitating Conditions, And Price Value drive teachers' acceptance. Whereas, on students' perspective, Xhafaj et al. [5] and Nikolopoulou et al. [6] both agree that Hedonic Motivation and Habit are the most important interpreters for students' Behavioral Intention to use technology in their studies.

2. LITERATURE REVIEW

The incorporation of Google Classroom in Malaysian primary schools in teaching and learning started in 2019 replacing Frog VLE. Google Apps for

Education (GAFE) was launched in 2014, and it is free to use for teachers and students, making it an ideal fit for developing nations with limited funds [9]. Google Classroom allows interactions between other web-based applications like Google Drive, Gmail, Google Meet, Google Docs, Google Hangout, Google Calendar, Google Form and more [5]. Furthermore, it can occur in a unidirectional process by serving educators' styles and techniques on the one hand and perception, knowledge, and successful involvement in diverse learning abilities on the other [10]. Some schools, colleges, and higher education institutes use Google Classroom as a learning management system as it is simple to use and comes with a secure application that aids instructors in managing, measuring, and enriching learning. Google listen to the feedbacks from educational communities around the world in order to improve their tools to elevate the teaching and learning techniques [11]. Teachers may post their resource materials, such as a syllabus, classroom rules, or topic-related reading, to the Classwork page in Google Classroom. Other types of resources [12] and materials can be organized by topic, reordered, and scheduled for later posting.

Out of 15 studies gleaned carried out for this paper, 2 were on Google Classroom acceptance, 5 were studies on mobile learning acceptance, 2 studies were on MOOCs acceptance and 6 were studies on others online learning platform acceptance. Table 1 summarizes the technology acceptance and the theoretical model used for each E-Learning platform described. The presented table below shows that, there are only a limited number of research studies focusing on Google Classroom's adoption as a teaching and learning tool. To add, UTAUT2/modified UTAUT2 model is the most used to predict users' acceptance of E-Learning platform. Therefore, this study will focus on Google Classroom acceptance by using UTAUT2 as the basic theoretical model. Eventually, proposed an extension of the model with additional construct for better understanding the users' acceptance.

Table 1 Summary of technology acceptance and E-Learning platform used for each theoretical model.

Platform	TAM/ modified TAM	UTAUT/ modified UTAUT	UTAUT2/ modified UTAUT2
• Google Classroom	1		1
• Mobile learning		2	3
• MOOCs		1	1
• Others online	1	1	4

2.1. The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model

The Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model is one of the significant models in the field of technology and education adoption which has been developed by [13]. UTAUT2 features not just the important relationships from UTAUT, but also additional constructs and relationships that expand UTAUT's applicability to the consumer context. UTAUT2 has been shown to be a valid model for understanding and forecasting user acceptance of new technology in a variety of contexts. UTAUT2 was found to be directly determined by Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Hedonic Motivation (HM), Price Value (PV), And Habit (H), with Age, Gender and Experience, as key modifiers that affected the constructs. Venkatesh et al. [13] verified the importance of Hedonic Motivation, Price Value, and Habit in affecting technology use, as well as in UTAUT2, which is adapted to the context of consumer acceptance and use of technology. The original model of the UTAUT2 is graphically depicted in Figure 2. Some studies on E-Learning platforms and their acceptance rates also reveal the relationship between acceptance and their effects. This study attempts to complete the missing parts of previous studies on the same subject, especially in the field of education. Further, this study will be able to explain which constructs of extended UTAUT2 model which made the Google Classroom accepted and used by the teachers in Malaysia.

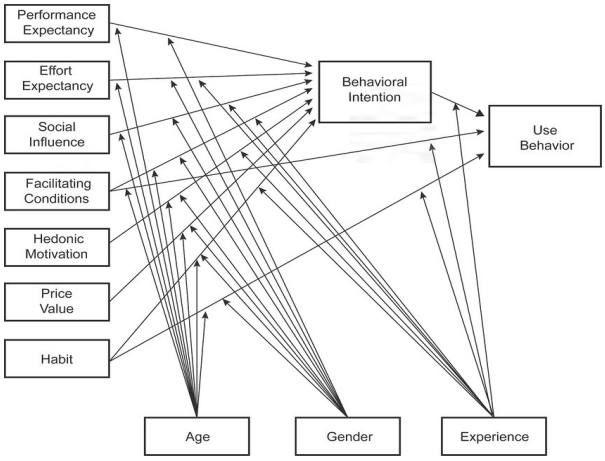

Figure 2 UTAUT2 Model.

2.2. Conceptual Framework

In this research, conceptual framework is proposed as shown in Figure 3. constructs of this study are UTAUT2 along with addition of three new constructs. The research model postulates Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Hedonic Motivation (HM), Price Value (PV), Habit (H), Personal Innovativeness (PI), Trust (T), and Self-Efficacy (SE) as independent variables, Behavioral Intention (BI) as mediator, and Use Behavior (USE) as dependent variable. The study adopts constructs form Unified Theory of Acceptance and Use of Technology2 (UTAUT2) by [13] but revised by [6,14,15]. This model is used to identify the factors that influence Malaysian teachers' intentions to use Google Classroom for teaching and learning purposes.

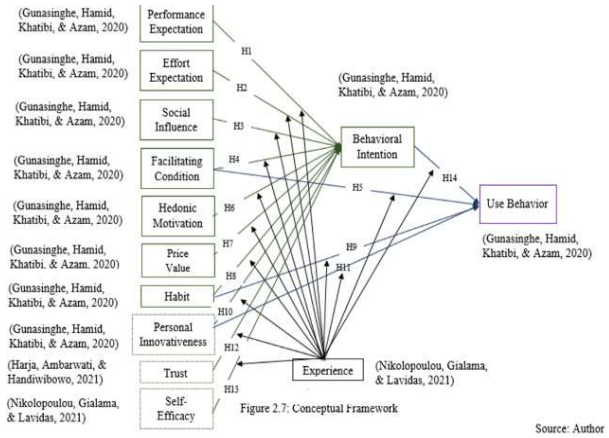

Figure 3 The conceptual framework

Performance Expectancy refers to the belief that the use of E-Learning Platforms will enhance teachers' performance in teaching and learning. Many researchers like [1,5,6,16-20] suggested that PE is a significant predictor of BI within the E-Learning. In addition, PE is one of most important factors affecting users' acceptance intentions to adopt Google Classroom among teachers in Malaysia. Therefore, if the end user realizes that Google Classroom seems to be more useful than other traditional learning technology, then they will be more easily to use it. Thus, it is hypothesized as follows: **Hypothesis 1:** PE has a positive effect on BI.

Effort Expectancy (EE) is identified as the degree of ease of use related with the information system. Generally, users tend to consider the effort required before using an information system. In earlier studies, EE has been identified as an important factor in the acceptance of innovative technologies. There are research results of [5,16,18,20] illustrating that EE has a direct impact on BI within the E-Learning system The EE of a Google Classroom would impact teachers' decisions about whether or not to utilise the technology. The following hypothesis is developed: **Hypothesis 2:** EE has a positive effect on BI.

The degree to which an individual feels that important others believe people should utilise the new system is defined as social influence (SI). SI is how other people, such as friends and family influence users' decisions to adopt the technology. SI impacted BI in many cases [4,18,20] but in other situations, it does not as in [16] and [19]. In addition, SI has played important role in originating teacher' BI to use the Google Classroom for online teaching and learning. The following hypothesis is offered: **Hypothesis 3:** SI has a positive effect BI.

Facilitating conditions (FC) refers to the consumer's view of the resources and support available to perform the behavior. FC refers to teachers' perceptions of the accessibility of institutional and technological infrastructures to enable the use of E-Learning Platforms. There are research results of [6,14,16,18] showing that FC has a direct effect on BI and USE within the E-Learning system. The current study hypothesised that FC had a considerable positive influence on both teachers' BI and USE of Google Classroom. Thus, researcher has: **Hypothesis 4:** FC has a positive effect on BI. **Hypothesis 5:** FC has a positive effect on USE.

Hedonic Motivation (HM) is defined as the degree of fun, enjoyment, or pleasure brought about by technological innovation, and it is acknowledged as a crucial factor in influencing technology acceptance and use. However, people with hedonistic motives are more focused on entertainment of Information System or Information Technology than people with utilitarian motives. The findings of [5,6,16-18,20] showed that BI is significantly influenced by HM to use E-Learning. If a person thinks that the use of Google Classroom is fun, enjoyable, and enjoyable, then he or she will be more likely to Google Classroom for adoption and usage within both E-Learning and information systems. The following hypothesis is offered: **Hypothesis 6:** HM has a positive effect on BI.

Price Value (PV) refers to the user's perceived value. PV is the difference between the total perceived benefits of applications and the total monetary or non-monetary costs of using them. Numerous studies in [6,14,16,18,19] have proven that price value is equally relevant, in explaining one's intention to acceptance an item, as other variables present in different technology acceptance models. PV is one of the important determinants of teacher's BI in using the Google Classroom. The following hypothesis is developed: **Hypothesis 7:** PV has a positive effect on BI.

Habit (H) described as the point where people plan to perform their behavior automatically due to learning or experience, and it determines both intention and usage of technology [6]. There are research results of [5,14,16,18] indicating that habit has a direct influence on behaviour intention and use behaviour in E-Learning The present study also conceptualized H to affect teacher's BI and USE Google Classroom. This discussion led to the following hypothesis: **Hypothesis 8:** H has a positive effect on BI. **Hypothesis 9:** H has a positive effect on USE.

Personal Innovativeness (PI) refers to inventive people who are highly informed of technology breakthroughs and appreciate obtaining the most recent news updates in their respective field of interest, allowing them to stay ahead of others in terms of technical know-how. According to the findings of [15,16], PI has a direct impact on BI and USE within the E-Learning system. According to the current study, PI has a strong positive effect on both teachers' BI and USE of Google Classroom. Thus, researcher has: **Hypothesis 10:** PI has a positive effect on BI. **Hypothesis 11:** PI has a positive effect on USE.

Trust (T) is defined as the Individuals' willingness to accept vulnerability as a result of positive expectations of others' intentions or actions in situations of interdependence and risk. In terms of information privacy and security, trust is a powerful factor in receiving technology. Numerous studies [14,19] have proven that T is equally relevant, in explaining one's intention to acceptance an item, as other variables present in different technology acceptance models. T has been established as a positive influencer and the most significant predictor of BI. The following hypothesis is thus formulated: **Hypothesis 12:** T has a positive effect

on BI.

The self-efficacy structure (SE) is a person's assessment of his or her capability to use technology, such as a computer, to achieve a specific activity. Several research have indicated that self is a key factor in influencing educational system engagement [1] stated that computer self-efficacy had a significant influence on MOOC usage intention. Self-efficacy has also been proven to have an impact on behavioural intention; this indicates that teachers' technology pedagogical expertise influences their intention to utilise mobile internet in their classrooms in a positive way [6]. The present study also conceptualized SE to affect teacher's BI of Google Classroom. The following hypotheses were proposed: **Hypothesis 13:** SE has a positive effect on BI.

Behavioral Intention (BI) is predictable in the domain of the psychological discipline. Henceforth, the impact of BI on Use Behavior (USE) is widely studied in the field of management science and engineering. The USE refers to the performance of an observable response in a predictable context related with given target. Researcher observed no major disagreement on the BI for the USE [6,17]. On the other hand, few research on the use of UTAUT2 indicate that intention to behave is one of the critical factors identifying the USE of a technology [6,15,16]. Moreover, BI influences the USE significantly in their studies. The following hypothesis is thus formulated: **Hypothesis 14:** BI has a positive effect on USE.

2.3. Moderating Effects

There are a few findings about the moderating influence of teachers' experience. In previous study of [6] has shown that user experience has been recognized as one of the main factors that ease the relationship between users' perceptions of technology and their behavioral intentions, users will gain experience when using the E-Learning Platforms because over time. In this research, researcher expect that the relationship between PE, EE, SI, FC, HM, PV, H, PI, T, SE, BI and USE are moderated by Experience (Exp) with Google Classroom.

2.4. Mediating Effects

In line with documented findings of [5,6,14-16,18] researcher can advance with theoretical and empirical observations that the impact of FC, H and PI on the BI results in the USE.

3. CONCLUSION

Google Classroom acceptance among STEM teachers has not been sufficiently researched. This study explores the UTAUT2 model and proposes a modification to study teachers' adoption of this technology. However, there are some limitations to this study, including the small number of publications reviewed and the proposed framework, which is based only on a literature review. Consequently, further research should be undertaken, with an emphasis on the empirical validity and reliability of the hypothesized conceptual framework.

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