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Validity and Reliability of a Conceptual Framework on Enhancing Learning for Students via Kinect: A Pilot Test

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Abstract – Traditional method of teaching poses two significant problems – not all students learn alike, and the physical interaction needed poses health risk during pandemic. As such, for these students, an alternative learning method such as those that uses natural user interface (NUI) can be considered. This method would be beneficial for kinesthetic type learners and can be conducted remotely. The alternative learning program is a complementary method, thus still incorporates the current subject syllabus. However, the delivery, learning and execution of the syllabus will be varied. In minimizing these gaps found in the current Malaysian education system, a conceptual framework utilizing Microsoft Kinect is proposed. Since this is a new framework, a pilot study is needed to gauge the validity and reliability of the survey instrument prior to embarking on further study on the outcome of the alternative learning program. Face and content validity conducted on the questionnaire were found to be clear, not confusing, and measures what the questions were supposed to measure. Reliability measured using Cronbach's Alpha indicated values above the acceptable range. Thus, these results indicate that the instrument is valid and reliable to be applied for data collection in the future study to assess the intention of Malaysian students to adopt an alternative medium for learning.

Keywords—*Alternative Learning, Kinect, Validity, Reliability.*

I. INTRODUCTION

In Malaysia, the public school system teaches every student in the same traditional method (mostly

face-to-face with blackboards, pens/pencils and papers method), which is not the objective “right way” to teach student, and this can lead to problems such as students not being able to understand the lessons as delivery is a “one model fits all communities”, and thus may discourage and causes lack of motivation in performing well. Furthermore, with the current COVID-19 pandemic, the traditional learning method will pose an even greater health risk to the students and teachers. Since the main issue that brought the above problems lies in the delivery method of the lessons, an alternative learning method to teaching will provide a passage to students to learn in a different manner. Interactive technology like Kinect, can act as a natural user interface (NUI). Many studies have benefited from Kinect [1], [2], [3], [4], such that Kinect would be applicable in education field; in this case, for any school children whose learning methods are not accustomed for in the existing learning situation in Malaysia. In minimizing these gaps found in the current Malaysian education system, a conceptual framework utilizing Microsoft Kinect is proposed. As this is a novel framework, the validity and reliability of the survey used in the framework needs to be tested to ascertain the feasibility and consistency of the framework [5]. Thus, the objective of this paper is to conduct a pilot study to gauge the validity and reliability of the instrument for further application soon.

II. LITERATURE REVIEW

A. *Related Models*

Several models are related to this study's objectives, namely Unified Theory of Acceptance and

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Use of Technology (UTAUT) model [6], Family Involvement Questionnaire (FIQ) [7], Family-School Relationships Survey [8], Intrinsic Motivation Inventory (IMI) [9], Concerns-Based Adoption Model (CBAM) in specific, Stages of Concern (SoC) [10], and Visual, Aural, Read/Write, Kinesthetic (VARK) [11].

1) *UTAUT*

UTAUT consists of four key factors and four moderators to predict the a person's behavioral intention of implementing a technology and thus leading that person to the actual usage of that technology. Venkatesh et al. [6] listed performance expectancy, effort expectancy, social influence, and facilitating conditions as the key factors, and age, gender, experience, and voluntariness as the model's moderators. UTAUT has been studied extensively, including in the field of education. The studies concluded that the first three key factors determine behavioral intention [12], [13].

Performance expectancy [14] refers to the person's assessment on whether a technology is useful for him/her [15]. Recent studies by Abbad [13], and Raza et al. [16] concurred previous results that performance expectancy can be used to predict a person's probability of using a technology.

Effort expectancy is the level of comfort with regards to using a system [2]. Researchers Too and Chang [1], Abbad [13], Dönmez-Turan and Kir [17] and Chen and Huang [18] in their individual studies confirmed that users' effort expectancy determined their behavioral intentions. Other research done includes the effects of moderators' gender [19], age [20], and experience [21], of which the studies showed significant influence.

Adapting from Venkatesh, Thong, and Xu [15], social influence is where the students feel that important people in their lives were supportive and encouraging in their use of technology.

Venkatesh, Thong, and Xu [15] akin facilitating conditions to having sufficient support and resources so a particular technology can be used effectively. Inadequate facilitating conditions have detrimental effect on acceptance of new technology [1], [12], [13], [22]. Facilitating conditions, when moderated by experience and age, will influence behavioral intentions of users.

The intention to use a technology has been shown to be moderated by the age factor [15]. This fact has been researched with contrasting outcomes [23].

The role of gender as a moderator has received conflicting results in the works of Venkatesh et al. [6], and Ostrow and Heffernan [24].

Experience with technology has been proven to significantly influence adopting a technology, whether positively [23], [25], [26], or negatively [27].

Behavioral intention is a direct determinant and behavioral disposition of actual behavior and has been well established in literature [28].

2) *FIQ and Family-School Relationships*

Parents and guardians are selected as studies have shown they have positive effect on children's

motivation, achievement, and self-esteem academically [21]. Considering this parental support in the home environment, the FIQ and the Family-School Relationships Survey were chosen. The FIQ is selected as it focusses on the parents and guardians' and their methods of supporting their children, in specific different types of exercises and practices in education context [7]. The Family-School Relationships Survey was developed to share information to schools regarding obtaining support and its effectiveness from parents/guardians [8].

3) *Motivation*

Students' performance is significantly affected by their motivation [1], [24], [29]. The IMI will be applied to assess students' interest/enjoyment, perceived competence, effort/importance, pressure/tension, perceived choice, value/usefulness, and relatedness. The IMI theory posits that students who have choices in tasks, have significant relation with their classmates and teachers, and feel capable to perform a task have higher likelihood to embody the task and perform well [9].

4) *Concerns-Based Adoption Model (CBAM) – Stages of Concern (SoC)*

The CBAM is developed for educators and contains three parts, namely, Stages of Concern, Levels of Use and Innovation Configurations [10]. Since our study intends to investigate the teachers' attitudes about curriculum change and implementation [30], only the Stages of Concern (SoC) will be investigated. The SoC's main focus is on teachers' attitude on changes in the curriculum and its implementation. Teachers' readiness in any study is scarce, with one exception in the work of [31]. Their study found that the attitude of lecturers were significant moderators to resources and influenced the usage of social networking sites.

5) *Learning Styles*

Balakrishnan and Gan [32] defined learning styles as the approach of how individuals interact, attain knowledge, or respond to external stimuli in their learning environments. Since different students learn differently, Huang et al. [33] proposed to include learning styles as a moderator instead of predictor, as supported by the works of Pratama and Pinayani [34]. They believed that by understanding students' learning styles, it will offer insights to develop better interventions that tailored to students' needs.

B. Validity and Reliability of Research Instrument

According to Wong and Yamat [35], validity is the precision of the survey questions in determining the proposed factors in the study. Validity is conducted via face, content, construct, and/or criterion. In this pilot study, the first two forms of validity will be tested. Face validity evaluates the survey on the surface to investigate its fitness and aptness with regards to the objective of the research; while content validity is the ability of the data collected to accumulate, review, and represent the factors that are assessed [35].

Reliability is defined by Braun et al. [36] as the stability and consistency of points from the survey questions. In this pilot research, Cronbach's Alpha test will be applied for this purpose. Cronbach's Alpha of at least 0.7 shows acceptable internal consistency [37].

III. METHODOLOGY

A. Development of Proposed Conceptual Framework

Figure 1 below represents the proposed conceptual framework which was developed from the related models and theories discussed in Part II.

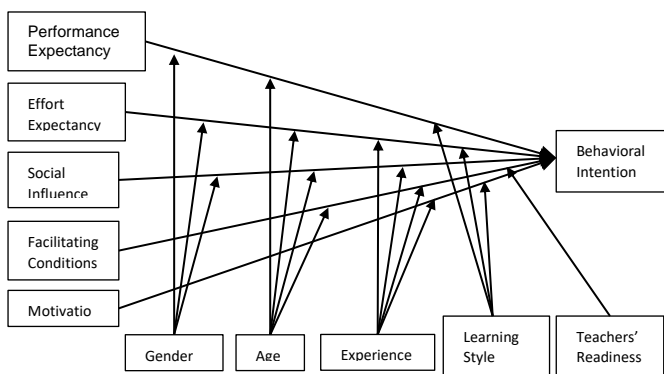


FIGURE 1. Proposed conceptual framework.

1) Performance Expectancy

Following the original UTAUT, this proposed framework will include two moderators, gender and age to the performance expectancy factor. Based on the literature, learning styles will also be included as another moderator that possibly could influence the behavioral intention of users.

2) Effort Expectancy

Previous studies on gender, age, and experience had shown significant influence. To this, we proposed that learning styles, as a moderator, will have effect on effort expectancy towards behavioral intention.

3) Social Influence

As involvement of parents has been shown to increase students' motivation achievements and self-esteem [36], this study will assess the different types of activities and practices that parents' organize for their children at home. This study will also investigate the relationship between parents and schools [8]. Social influence is moderated gender, age, and experience [38].

4) Facilitating Conditions

This study's support and resources include availability of the teachers and adequate basic resources and needs such as laptop/desktop, Microsoft Kinect camera and adequate information and instructions. Since teachers' role are crucial in determining the students' behavioral intentions, thus we have added in the teachers' readiness to embrace the new technology as another moderator [6].

5) Motivation

As motivation plays a significant role in students' effectiveness, this variable is added into the proposed framework. Motivation is posited to be influenced by moderators' gender, experience, and learning styles [26], [34], [39].

6) Gender

Research results on the significant differences in gender leads us to propose that gender will affect performance expectancy, effort expectancy, and social influence as a moderator towards the behavioral intention.

7) Age

Due to contrasting results on effects of age, and this research focused on different age groups, thus the age factor will be investigated as a moderator towards performance expectancy, effort expectancy, social influence, and facilitating conditions.

8) Experience

Considering experience has significant influence on technology adoption, this study attempts to assess this moderating effect of effort expectancy, social influence, facilitating condition, and motivation on intention to use Kinect.

9) Learning Style

It is our belief that students be given the opportunity to learn and adapt based on their individual learning styles such as visual, auditory, read/write, and kinesthetic. The different learning styles will act as a moderator for performance expectancy, effort expectancy and motivation. Among the many learning styles available, VARK learning styles is the most relevant as the learning styles represent the diverse learning styles in students. VARK presents four learning styles - visual, auditory, read/write, and kinesthetic.

10) Teachers' Readiness

For teachers' readiness variable, we focused on the teachers themselves, specifically their characteristics and attitudes with regards to changes in curriculum and its implementation. This prompted us to propose that teachers' readiness will moderate the effect of facilitating conditions on the students' intention to use Kinect.

11) Behavioral Intention

The present study measures the students' behavioral intention to use Kinect instead of their actual behavior and focuses on exploring the factors that will affect their behavioral intentions to use technology, along with how moderators' gender, age, experience, learning styles, and teachers' readiness will affect their behavioral intention.

B. Development of Research Instrument

The proposed framework adapted questions from several different frameworks, namely, UTAUT [6], SoC [10], FIQ [7], Family-School Relationships

Survey [8], IMI [9], and VARK [11]. The questions were edited to ensure the suitability to the targeted respondents. Respondents were required to choose responses using Boolean (for demographic questions), multiple choice questions (for learning styles questions), and 7-point Likert scale, with ranges from strongly disagree to strongly agree (for the remaining questions).

C. Procedure

This pilot study applies the proposed framework discussed earlier using questionnaires as its instrument. Conducting pilot study allows the identification of any weakness and thus enables modifications to be done prior to the actual data collection [39]. Usually at least 12 to 50 pilot testers are required. Thus, a sample total of 20 students were collected from students (ranging from ages 8-9 years old), their parent/guardian, and teachers from one of the targeted schools in Melaka.

IV. RESULTS AND DISCUSSION

For face validity, the questionnaire was analyzed by a Primary 3 teacher to ascertain the viability and suitability of the questions for students in Primary 2 and 3. The teacher is currently teaching in the same school as the pilot study respondents. Based on the teacher's comment, the questions were straightforward and unambiguous. For the content validity, the same teacher evaluated and reported that the survey questions consist of UTAUT, parents' support, motivation levels, learning style and stages of teacher's concern. Based on the positive outcome, the questions were confirmed to be valid. Based on those results, the reliability test was conducted. The Cronbach's Alpha values for all the variables in this study are above 0.7, which indicates a good reliability [37]. Table 1 shows these results. Overall, these results indicate that the instrument used has good validity and reliability.

TABLE 1. Results for validity and reliability tests.

Construct	Cronbach 's Alpha
Performance Expectancy	0.728
Effort Expectancy	0.732
Social Influence (Parents' Support)	0.748
Facilitating Condition	0.743
Motivation	0.797
Behavioral Intention	0.736

V. CONCLUSION

In conclusion this paper has presented the work involved on a pilot study of the proposed conceptual framework for another learning method in Malaysia's education setting. The pilot study was conducted to gauge the validity and reliability of the instrument that will be used in the main research. For validity, the face and content validity tests were conducted; whilst the Cronbach Alpha test was performed for the reliability of the instrument. Based on the results, it can be concluded that the survey used is valid and reliable to be employed for data collection in the future study of

assessing the behavioral intention of Malaysian students to adopt an alternative medium for learning. As the instrument has been shown to be validated and obtained a good reliability, further studies can be done to establish the effectiveness of this framework.

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