Exploring Learner's Satisfaction and Adopting Intention toward Task-Technology-Fit Theory in Gesture-based Learning System for Computer Assisted Circuit Learning

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Abstract

Gesture-based learning with Kinect will increase the learning activities performance by adding simulation interaction and situational action element. The aim of this paper is to develop a gesture-based learning system, allowing users to use skeletal tracking to capture the body movements, enabling learners to control and interact with the computer without any intermediary controller while learning circuit course, and adopting Task-Technology-Fit theory to explore and discuss the learner's satisfaction and intention. Based on 30 valid samples and data analysis, this paper found that learners' awareness, task characteristic, technology characteristic and personal characteristic were highly related to task-technology fit. Furthermore, task-technology fit also significantly affected learner's satisfaction and their adopting intention of the gesture-based learning system.

Keywords: *Gesture-based learning, Task-Technology Fit theory, Embodied Interaction, circuit course*

1. Introduction

The advancement of human computer interaction technologies has offered an opportunity for providing support for learning activities with digitalized supplementary materials. On the user interface design, Natural User Interface (NUI), that is based on gesture and voice-based interface. For example, Kinect is a motion sensing input device. The device comes with an RGB camera, a depth sensor, and array of microphones, which in combination provide full-body 3D motion capture capabilities and gesture recognition. It enables users to control and interact with the game console without the need to touch a game controller, through a natural user interface using gestures and voice (Dutta 2012). Recently, the Kinect sensor is also widely applied to many professional areas of applications including medicine, entertainment, education, and many others (Kean et al. 2011). For example, using a Kinect and commodity graphics hardware, Richard et al. (2011) presented a system for accurate real-time mapping of complex and arbitrary indoor scenes. Weise et al. (2011) further captured and tracked the facial expression dynamics of the users in real-time and map them to a digital character.

The appearance of Kinect certainly draws the attention of educators and encourages the evaluation of its feasibility in education (Hsu 2011). However, the current experiments and developments with Kinect are still in a primitive stage, it lack of proper strategies or tools to assist the students to learn. Researchers are not clear about how kinesthetic interactions can enhance learning. Therefore, a gesture-based learning system for computer assisted circuit learning approach is proposed in this research to address the question of how task–technology fit influences the performance impacts of the gesture-based learning system. We use Task-Technology-Fit theory for base to explore the use of the gesture-based learning system, to discuss the user satisfaction and adopting intention through the result of this study. The primary research question investigated in this study was

(1) Does learners' task characteristic, task characteristic, technology characteristic and personal characteristic impact task-technology fit of the gesture-based learning system?
(2) Does task-technology fit also impact learner's satisfaction and their adopting intention of the gesture-based learning system?
(3) Does learner's satisfaction impact their adopting intention of the gesture-based learning system?

2. Literature Review

2.1 Gesture-Based Technology

Gesture-based learning have particularities, because users interact in the learning process through the actual way, just like they interact in the nondigital world. Gesture-based computing can be viewed as an innovative educational development in alignment with bodily-kinesthetic intelligence. It also can support kinesthetic pedagogical practices to benefit users with strong bodily-kinesthetic intelligence. It involves devices controlled by natural movements of the finger, hand, arm, and body (Johnson et al. 2010). The Microsoft Kinect Sensor is a 3D scene-capturing device developed by PrimeSense company in collaboration with Microsoft, introduced in

2010. The Kinect sensor was initially sold as a gaming accessory for Microsoft Xbox game console and its main purpose was offering a new and revolutionary way of interacting with games. Kinect enables users to control and interact with the game console without the need to touch a game controller, through a natural user interface using gestures and voice commands (Dutta 2012).

All the scholars emphasize the technical innovation with Kinect applied to educational assistance. As Hsu (2011) indicates, its kinesthetic features and gesture-based interaction surely will encourage educators to devote themselves to kinesthetic pedagogical practices in the classroom instruction. Nowadays, the gesture-based technology is applied in divergent realms. For example, Chang et al. (2011) use a Kinect-based system to assess the possibility of rehabilitating two young adults with motor impairments. Data showed that the two participants significantly increased their motivation for physical rehabilitation, thus improving exercise performance during the intervention phases. Chang et al. (2011) use a Kinect-based task prompting system to assess the possibility of training two individuals with cognitive impairments, the result have shown that the two participants significantly increased their target response, thus improving vocational job skills during the intervention phases. Tong et al. (2012) using Kinect scanning 3D full human bodies, the experimental results have shown the efficiency and applicability of the system. Chiang et al. (2012) using Kinect to explore health benefits in somatosensory video games, Xbox 360 Kinect, on institutionalized older adults with wheelchairs. The study concluded that Xbox 360 Kinect is a potential tool to improve visual performance skills for the institutionalized elderly with wheelchairs.

However, the current experiments and developments with Kinect are also still in a primitive stage. If Kinect comes with software for teachers to design the control over computers, it would surely become a powerful interactive educational technology (Hsu 2011). Consequently, we develop a gesture-based learning system, allowing users to use skeletal tracking to capture the body movements, enabling learners to control and interact with the computer without any intermediary controller while learning circuit course.

2.2 Task–technology fit

Goodhue & Thompson (1995) proposed that an explanation of information systems success needs to recognize both the task for which the technology is used and the fit between the task and the technology. As Goodhue & Thompson (1995) defines, task–technology fit meant the degree to which a technology assists an individual in performing his or her portfolio of tasks. They developed the technology-to-performance chain (TPC) as a model to help users and organizations understand and make more effective use of IT. The model proposes that task–technology fit is a function of task characteristics, technology characteristics, and individual characteristics. Task–technology fit in turn both directly influences performance, and indirectly influences utilization via precursors of utilization such as expected consequences of use, attitude towards use, social norms, habit and facilitating conditions. Utilization is also proposed to directly influence performance. The basic argument is that for a technology to have a positive impact on individual performance, the technology must fit with the tasks it is supposed to support, and it has to be used.

Other realms in which parts of the model have been tested include software development (Dishaw & Strong, 1998), managerial decision making (Goodhuez et al. 2000) and health care (Pendharkar et al. 2001). The most comprehensive test of the model to date is Staples & Seddon's (2004) study which considered use of a library cataloguing system by staff and use of spreadsheet and word processing software by students. The result have shown that TTF in the performance of use, the beliefs of use and attitudes have a significant impact. However, the role of task–technology fit has not yet been investigated in the e-learning realms. In this study, we adopting Task-Technology-Fit theory to explore and discuss the learner's satisfaction and intention of the gesture-based learning system. Figure 1 shows the Model tested in the study.

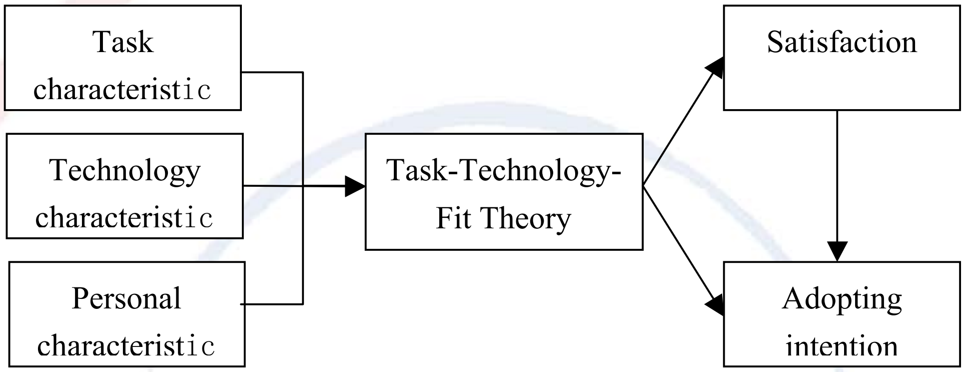

Figure 1: Model tested in the study

3. Research Method

3.1 Experiment System

Figure 2 shows the structure of the gesture-based learning system for supporting circuit course. This research uses the Kinect sensor to develop a gesture-based learning system for supporting circuit course, system functions are speech recognition, gesture recognition, instant quizzes. Accordingly, additional learning materials with phenomenon explanations and realistic illustrations were developed, including digital text, images, to help students comprehend the learning content. Learners can learn circuit course by gesture recognition and voice recognition, just like they interact in the nondigital world.

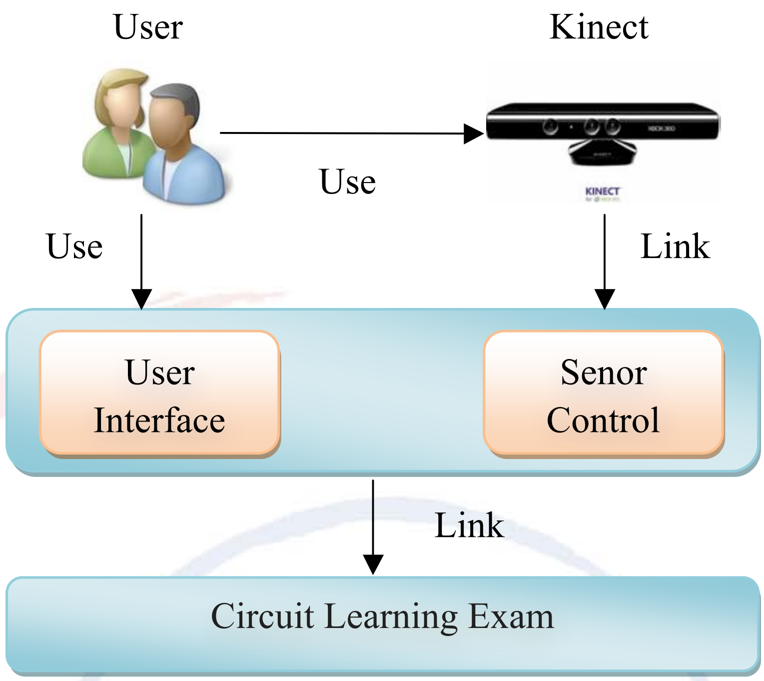

Figure 2: System Structure

3.2 Measurement

The questionnaire of Task–technology fit was modified from the questionnaire items developed by Goodhue & Thompson (1995). It was used to explore learner's satisfaction and adopting intention toward Task-Technology-Fit Theory with a 7-point Likert scale, where '7' represented 'strongly agree' and '1' represented 'strongly disagree.' The participants were 30 college students who have been used the gesture-based learning system.

3.3 Data analysis

The relationships in the model were tested using partial least squares (PLS). PLS provides an alternative estimation approach to traditional structural equation modeling (SEM). A two-step approach commonly used in SEM techniques was used to evaluate model fit. The approach involves first testing the fit and construct validity of the proposed measurement model and then, once a satisfactory measurement model is obtained, the measurement model is ''fixed" when the structural model is estimated (Hair et al. 2006). SmartPLS version 2.0 was used to assess the measurement model and the structural model.

4. Research Result and Discussion

A total of 30 college students participated in the study. Whilst being essentially a convenience sample, the participants covered a broad spectrum of IT experience and training. They had a wide range of levels of usage of the gesture-based learning system. Figure 3 shows the standardized coefficients for each hypothesized path in the model and the R^2 for each dependent variable. Based on 30 valid samples and data analysis, this study found that learners' awareness, task characteristic, technology characteristic and personal characteristic were highly related to task-technology fit.

Furthermore, task-technology fit also significantly affected learner's satisfaction and their adopting intention of the gesture-based learning system.

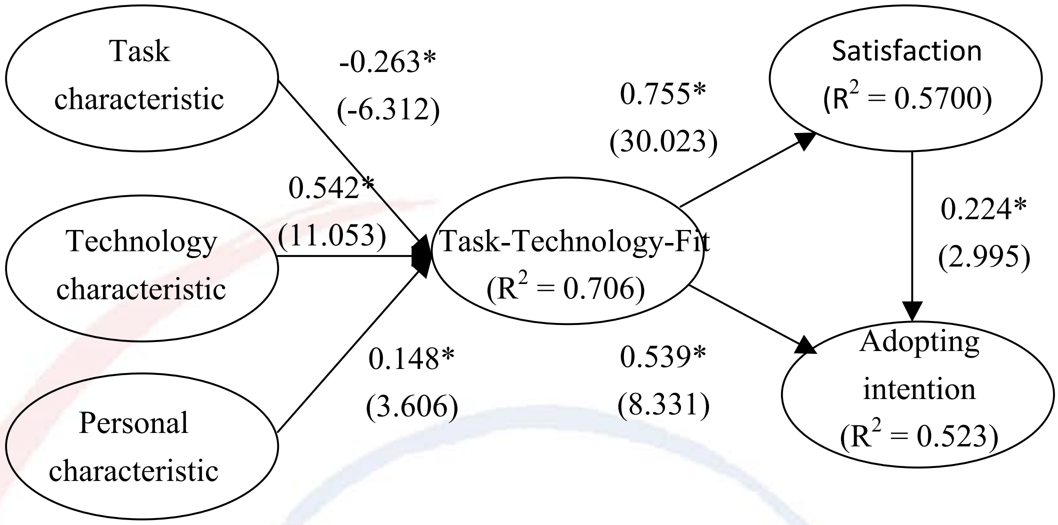

Figure 3: Structural model results

The ability of the model to explain the variance in the dependent variables was the second criterion used to evaluate the model. The R^2 values are measures of the ability of the model to explain the variance in the dependent variables and are reported in Figure 3. The model explained 70.6 of the variability in Task-Technology-Fit, 57.0% the variability in Satisfaction, 52.3% the variability in Adopting intention.

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