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Understanding the Effect of Flickr's Screenshot Annotations on Learning Effectiveness

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ABSTRACT

As Flickr provides users with a highly interactive photo-sharing environment, this study was performed to make use of Flickr's annotation function to support computer software learning. After users upload their screenshots onto Flickr, they can make three types of annotations—stickers, drawings, and text—to pinpoint the specific portion of the screenshot. Thus, software problems can be described more clearly than with text alone and can be solved with greater certainty. The results, based on data collected from 270 students, indicated that the students' perceived usefulness had a positive influence on online participation, which in turn led to learning effectiveness. These findings are limited to technology-oriented classes.

KEYWORDS: Annotation, perceived usefulness, course difficulty, online participation, learning effectiveness

INTRODUCTION

As e-learning environments have progressed over the past decade, a variety of innovative information technologies and information systems have been developed for educational courses. Social networking sites such as MySpace, Twitter, and Facebook have become enormously successful because of their everyman appeal and have become the most popular platforms for interaction with the world over the Internet. Educators have tended to treat social networking sites as multifunctional platforms for teaching and learning by means of argumentation and discussion (Kalpidou, Costin, & Morris, 2011; Yang & Brown, 2015; Ainin, Naqshbandi, Mogavvemi, & Jaafar, 2015), as students using them have greater opportunities to obtain course materials and interact with their classmates. Hence, teachers and learners alike need to embrace the latest means of interacting with people, course materials, and even data to enhance learning effectiveness.

Improved learning techniques in computer courses is always needed as students sometimes have problems with grasping the material using traditional learning methods. Several social networking sites such as Flickr and Facebook enable users to upload and share photos. Furthermore, they are able to create tags or dialog boxes above the photos. By doing so, people can focus on a specific portion of the photo of interest and interact with friends by leaving comments. This photo-sharing environment can be an innovative method for learners to

demonstrate their problems by posting screenshots when they encounter computer software difficulties (Huang, 2015). In particular, Flickr provides its users with a highly interactive photo-sharing environment. After users upload their screenshots onto Flickr, they can make three types of annotations—stickers, drawings, and text—to pinpoint the specific portion of the screenshot by means of the annotation tools, namely photo editor, as shown in Figure 1. Every screenshot is unique and personalized after annotation. As shown in Figure 2, a sticker annotation can be made by drawing a rectangle, locating its position, and adjusting its size. Besides, users can enter text above a screenshot by using text tools, as presented in Figure 3. Hence, software problems can be described more clearly than with text alone and can be solved with greater certainty.

Figure 1: Annotation tools on Flickr

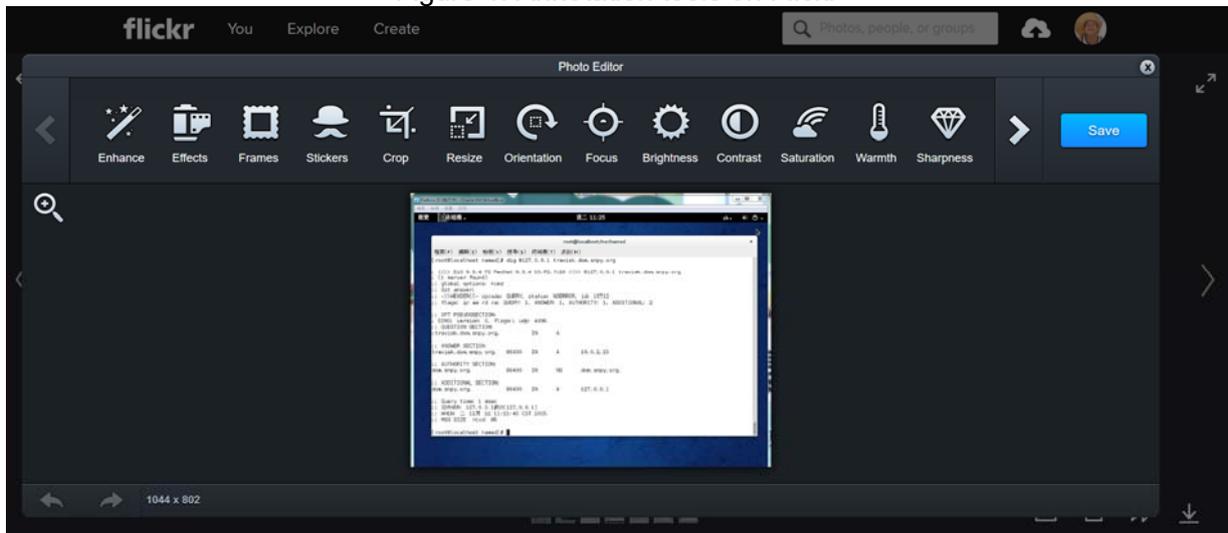


Figure 2: Creating a sticker annotation to a screenshot

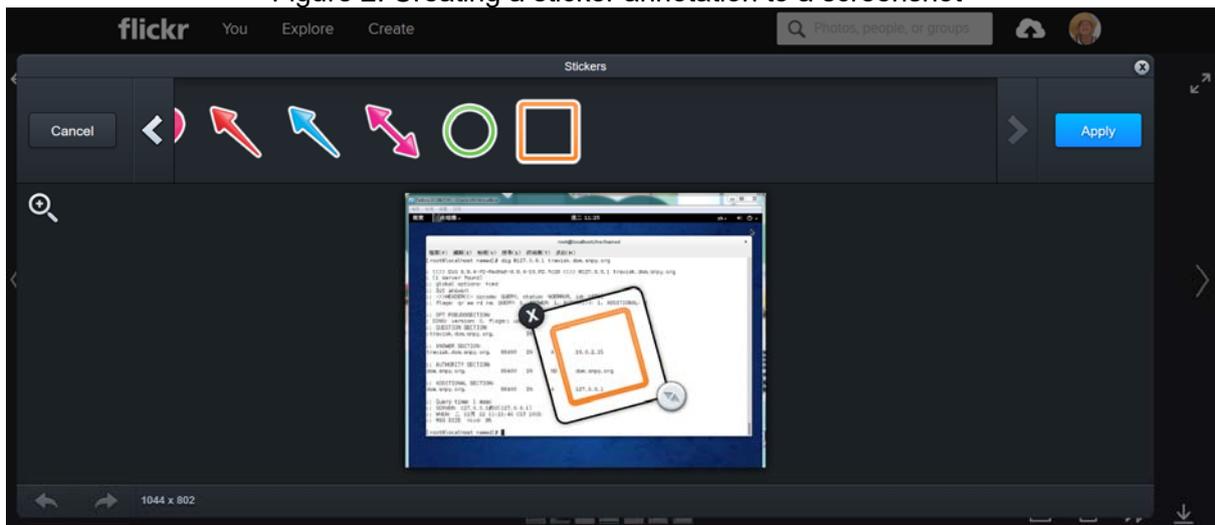
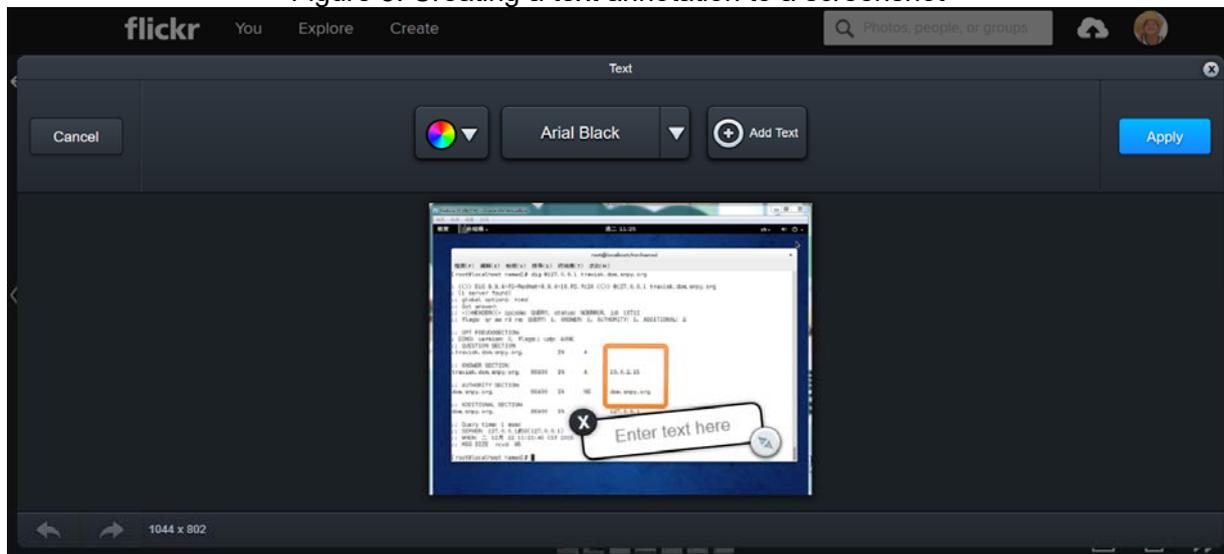


Figure 3: Creating a text annotation to a screenshot



In this study, the course difficulty and the perceived ease of use were used as two critical factors to explain the students' perceived usefulness of new information technologies in the field of e-learning. Hence, this study was performed to answer the following questions: What is the relationship between users' perceived ease of use and the usefulness of Flickr's screenshot annotations for learning computer software? What is the relationship between course difficulty and the usefulness of Flickr's screenshot annotations? What is the relationship between the usefulness of Flickr's screenshot annotations as perceived by users and their learning effectiveness? What is the relationship between the usefulness as perceived by users and online participation? What is the relationship between online participation and learning effectiveness?

LITERATURE REVIEW

Annotations on Flickr

Annotation systems have been developed in recent years to enhance the effectiveness of e-learning. Most systems have focused on text-based annotations, which can be created by highlighting a specific portion of the selected article. For example, Su, Yang, Hwang, and Zhang (2010) developed a personalized annotation management system that was useful for conducting learning tasks. Gao (2013) investigated student participation and interactions when studying an online text with the social annotation tool Diigo. In addition, Chen, Hwang, and Wang (2012) developed a Web 2.0 annotation system, MyNote, for users to leave comments in response to text-based annotations of interest. By doing so, users can read and discuss specific portions of the course materials directly. In fact, text-based annotation is useful for peer critiques (Mendenhall & Johnson, 2010), which can stimulate learners to think through issues and reflect on their own opinions. Thus, learners have more opportunities to elicit deeper learning (Huang, 2015).

This study investigated the interactions that occur between users as they use Flickr's annotations on screenshots to demonstrate their problems. Three types of annotations—stickers, drawings, and text-based annotations—can be used on Flickr. As shown in Figure 1, a

software problem is presented by creating annotations on a screenshot with Flickr's photo editor. To clarify the meaning of a specific screenshot, a user can create stickers, draw a rectangle, or create a text-based annotation that includes further explanation. Stickers, drawings, and text-based annotations are all considered screenshot annotations for the purposes of this study.

Flickr's annotation function is very useful for students, especially for computer software learners. When students encounter unpredictable problems, they may not be able to properly describe the problem. Posting screenshots onto Flickr and making annotations can be allow others to help troubleshoot these problems. In short, the Flickr website provides a highly interactive and intuitive environment in which students can depict or comprehend computer software problems with annotations, including stickers, drawings, and text, above a specific screenshot.

Perceived Usefulness

When e-learning systems were introduced to organizations such as industries and universities, they were treated as new information technologies. Many studies have evaluated users' acceptance of e-learning systems by application of the TAM (Davis, Bagozzi, & Warshaw, 1989; Lewis, Agarwal, & Sambamurthy, 2003; Huang, 2015). The TAM adopts the premise that users' ideas about the usefulness and perceived ease of use of a new information technology are the major determinants of their behavioral intentions, and that the perceived ease of use affects the perceived usefulness. In addition, users' behavioral intentions regarding information technology influences their actual usage behavior.

The information technology measured in this study is the use of Flickr's annotations, including stickers, drawing, and text. Because the TAM has successfully explained user acceptance of new information technologies (Venkatesh & Bala, 2008; Dickinger, Arami, & Meyer, 2008), the relationship between users' perceived ease of use and perceived usefulness has been confirmed. As the study intended to identify the antecedents of the users' perceived usefulness of the use of Flickr's annotations, users' perceived ease of use was adopted without question. Hence, the hypothesis based on the fundamental relationship of this TAM was proposed as follows.

Hypothesis 1: The greater users' perceived ease of use, the greater the perceived usefulness of making annotations by using stickers, drawing, and text on Flickr.

Course Difficulty

There are obviously numerous aspects of task difficulty. The aspect that is most relevant to the context of computer software learning is course difficulty, which has been found to have a negative association with learning outcomes and achievement within student groups (Tucker, Jones, Mandy, & Gupta, 2006; Addison, Best, & Warrington, 2006). Although students perceive a higher degree of course difficulty, they spend more time learning the subject by trying to solve the puzzles encountered. This leads to a greater level of academic stress (Tucker, Jones, Mandy, & Gupta, 2006). A high level of difficulty will have a significant effect on students' learning outcomes.

Course difficulty is the degree of difficulty of the subject matter. In this study, the subject matter is computer software, namely, the Linux operating system. A series of tasks about Linux instructions were included in the course. In this study, the course difficulty was defined as the degree of difficulty perceived by the students after they performed a series of tasks. While

learning Linux, students often encounter problems of different levels of equivocality and uncertainty. We expect that when students learn computer software with a lower level of difficulty, it is much easier for them to practice software instructions by uploading homework or by troubleshooting for others. In addition, students are more likely to be able to comprehend and solve software problems. Thus, they have more opportunities to interact with others by using stickers, drawing, and text on Flickr. The students should thus demonstrate a higher degree of perceived usefulness, which leads to the following hypothesis.

Hypothesis 2: The lower the level of course difficulty, the greater users' perceived usefulness of making annotations with stickers, drawing, and text on Flickr.

Learning Effectiveness

The perceived effectiveness of an e-learning system should be considered in an assessment of its effectiveness (Bostrom, Olfman, & Sein, 1990). Maki, Maki, Patterson, and Whittaker (2000) also proposed that the degree of satisfaction of an online course and learning achievement are critical for learning effectiveness. In addition, Lowerison, Sclater, Schmid and Abrami (2006) suggested that positive learning experiences include feelings of effective interactions with the instructor and other students and feelings of being in control of one's own learning by means of active participation. In this regard, we included students' perceived satisfaction in our measurement of the effectiveness of the learning experience. When students perceive a higher level of usefulness by making annotations with stickers, drawing, and text on Flickr, they should perceive a higher level of learning effectiveness. The following hypothesis was proposed.

Hypothesis 3: The greater users' perceived usefulness of making annotations with stickers, drawing, and text on Flickr, the greater the learning effectiveness.

Online Participation

Online collaborative environments have also been proven to encourage wider student participation because online discussions encourage more reticent students to participate to a greater extent (Citera, 1998), possibly because online environments provide fewer opportunities for intimidation and less time pressure (Warschauer, 1997). Thus, when students perceive an e-learning environment to have a high level of usefulness, their online participation increases. This study posits that users' perceived usefulness predicts the level of online participation. This concept is captured in the following hypothesis.

Hypothesis 4: The greater users' perceived usefulness of making annotations with stickers, drawing, and text on Flickr, the greater their online participation.

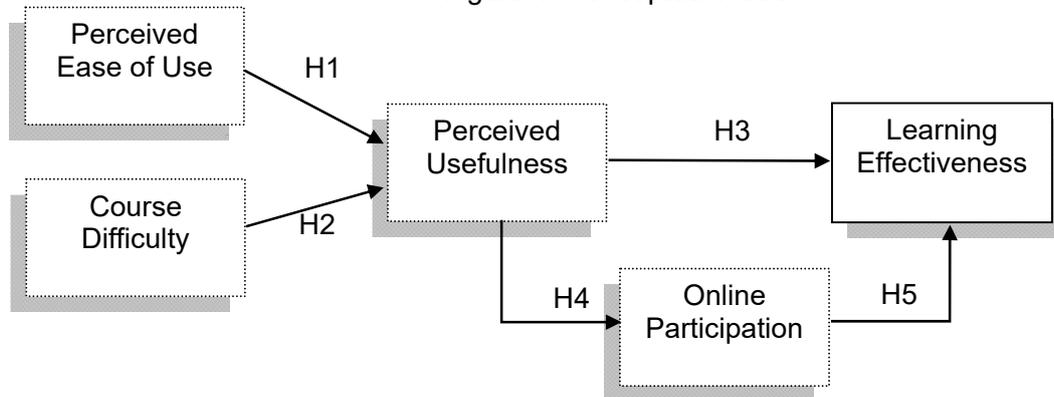
In a computer-supported collaborative learning community, learners' performance is significantly affected by social network properties (Cho, Gay, Davidson, & Ingraffea, 2007), which are a consequence of online participation. Therefore, if users make greater efforts to participate by making annotations with stickers, drawing, and text on Flickr, their learning effectiveness will improve. Based on the foregoing reasoning, the following hypothesis is proposed.

Hypothesis 5: The higher the level of online participation, the greater the learning effectiveness.

The goal of this study was to explain how two factors, perceived ease of use and course difficulty, affect perceived usefulness. In addition to the direct effects of perceived usefulness on

learning effectiveness, the indirect effects by means of online participation were also measured. The complete research model is shown in Figure 4.

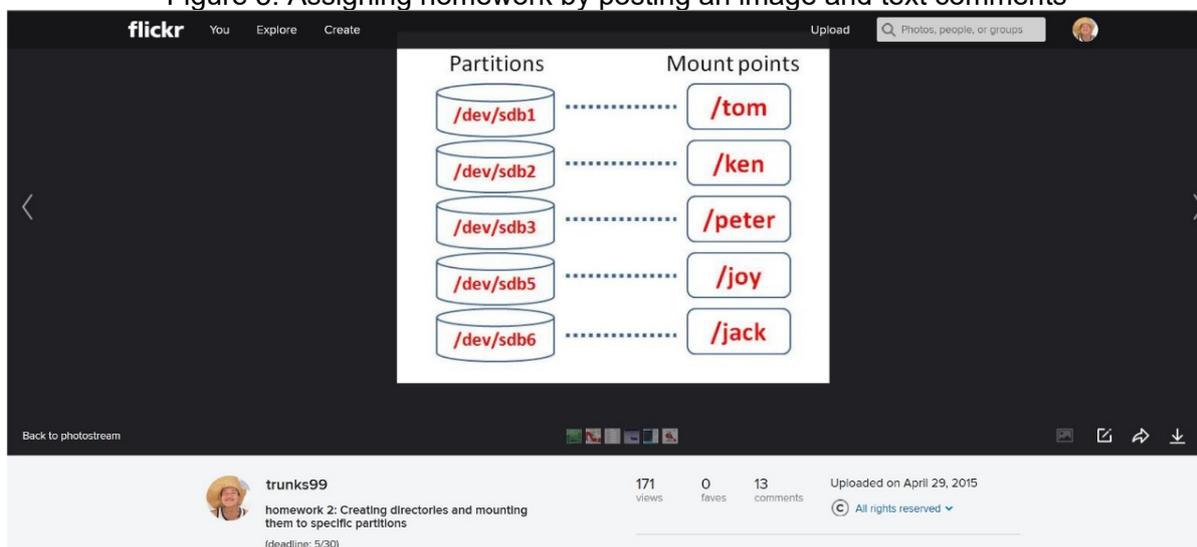
Figure 4: Conceptual model



RESEARCH METHOD

Two hundred eighty-three undergraduates majoring in information systems from six sections of the same Linux operating system course were recruited over the course of three semesters. As a major part of the course requirement, the students registered as Flickr members and were required to hand in assignments and to propose questions by means of Flickr. As shown in Figure 5, when homework was assigned, the teacher created a web page on Flickr with images and descriptions.

Figure 5: Assigning homework by posting an image and text comments



Each homework assignment could be captured in the form of a screenshot. Once the students completed their homework, they uploaded screenshots and posted their Flickr links to the teacher's web space. The students were encouraged to respond to the screenshots posted. Because the students were familiar with social networking media such as Facebook or Flickr they were able to use screenshots and annotations smoothly and fluently.

To investigate the manner in which Flickr's screenshot annotations affect students' learning effectiveness while learning computer software, questionnaires were administered to all 283 students. The students were aware that they were involved in a project but were blinded to the research hypotheses. The questionnaire assessed the perceived ease of use, perceived usefulness, course difficulty, and learning effectiveness after using Flickr's screenshot annotations to upload homework, demonstrate problems, and reply to other students' questions in the context of learning Linux. Two experts codified the students' online participation by evaluating their personal pages and the teacher's web space. The research model shown in Figure 4 was tested, and all of the hypotheses were examined by means of structural equation modeling using the collected data.

The dependent variable was the students' learning effectiveness. The independent variables were the students' perceived ease of use, perceived usefulness, course difficulty, and online participation, which was codified according to the student's usage of Flickr screenshots and annotations. The measurement of each construct is further described as follows.

Perceived Ease of Use and Perceived Usefulness

The items used to measure perceived ease of use and perceived usefulness were adapted from Davis (1993) with modifications. Four items examined perceived ease of use, and three items examined perceived usefulness. The items focused on measuring the students' ease of use and perceptions of usefulness in relation to Flickr's screenshot annotations. The Cronbach's α values for perceived ease of use and perceived usefulness were 0.935 and 0.969, respectively.

Course Difficulty

Addison, Best, and Warrington (2006) developed the Course Experience Questionnaire (CEQ) to measure course difficulty as perceived by students and to evaluate the instructor with 10 items. In this study, four items of interest from this questionnaire were adapted to measure the degree of students' perceived course difficulty. The Cronbach's α value for this four-item measure was 0.937.

Online Participation

The online participation data were codified by two experts from the students' online trials and included the frequency of screenshots and annotations on Flickr. Online participation was evaluated by several indicators, including the number of screenshots posted, the number of annotations created (e.g., stickers, drawings, and text), and the total number of comments posted. These indicators were combined into a single factor, online participation, that assessed the number of objects posted by the students.

Learning Effectiveness

Learning effectiveness was measured by the students' perceived satisfaction with their learning experiences as indicated on a seven-item scale (Lowerison, Sclater, Schmid, & Abrami, 2006). The students were asked to indicate how effectively the Flickr screenshot annotations were used in the course. The last two items were eliminated on the basis of an item-total correlation test. The Cronbach's α value for this five-item measure was 0.888.

RESULTS

Of the 283 students attending the class, 270 completed the questionnaires, giving a response rate of 95.4%. The correlations between the variables were tested using Pearson’s correlation coefficient. As shown in Table 1, course difficulty was negatively related to other variables except online participation, whereas online partition was positively related to perceived usefulness and learning effectiveness.

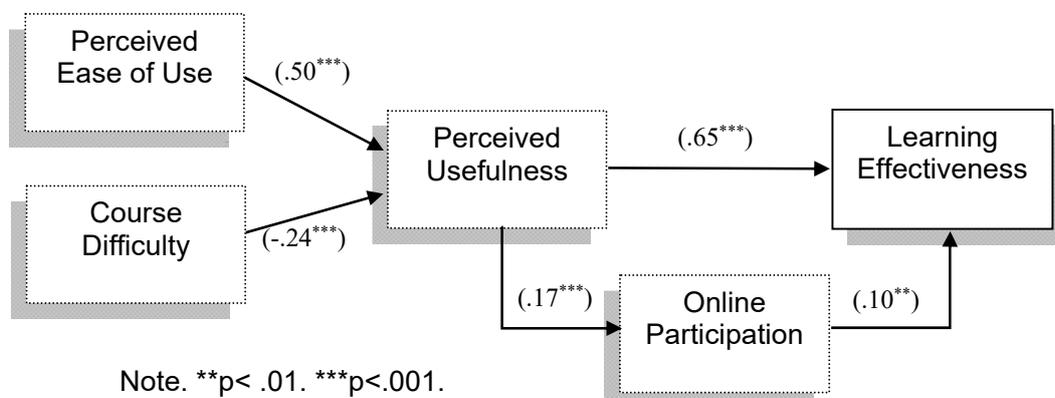
	1	2	3	4	5
1. Course Difficulty	1				
2. Perceived Ease of Use	-.348**	1			
3. Perceived Usefulness	-.422**	.577**	1		
4. Online Participation	-.060	.140	.156*	1	
5. Learning Effectiveness	-.280**	.413**	.624**	.190**	1

Note. *p< .05. **p<.01.

Structural Model

Using the 270 records, the proposed model was assessed with maximum likelihood estimation using AMOS. Six common model-fit measures were used to assess the model’s overall goodness of fit, the ratio of the chi-square value to the degrees of freedom (CMIN/DF), the goodness-of-fit (GFI), the adjusted goodness-of-fit index (AGFI), the comparative fit index (CFI), the root mean square error of approximation (RMSEA), and the normed fit index (NFI). The results indicated that the proposed model (CMIN/DF, 2.18; GFI, 0.91; AGFI, 0.87; CFI, 0.97; RMSEA, 0.07; and NFI, 0.95) had a good fit, because all of the criteria were better than the recommended values (CMIN/DF less than 3, GFI greater than 0.90, AGFI greater than 0.80, CFI greater than 0.95, RMSEA less than 0.80, and NFI greater than 0.90). We therefore used the model to examine our hypotheses.

Figure 7: Standardized path coefficients of the proposed model



As shown in Figure 7, the standardized path coefficient from perceived ease of use to perceived usefulness, which is one of the fundamental TAM relationships, was positive, and the relationship was statistically significant. Hypothesis 1 was thus supported. In addition, the path from course difficulty to perceived usefulness was statistically significant, and the standardized path coefficient was negative, thereby supporting Hypothesis 2. Therefore, perceived ease of use and course difficulty were shown to be antecedents of perceived usefulness.

Both perceived usefulness and online participation were found to have direct positive effects on learning effectiveness, thus confirming Hypotheses 3 and 5. In addition, the relationship between perceived usefulness and online participation was statistically significant, thus confirming Hypothesis 4. We can tell from Hypotheses 3, 4, and 5 that perceived usefulness had both direct and indirect effects on learning effectiveness because of its direct effect on online participation.

Through its direct effects on perceived usefulness, perceived ease of use had a positive indirect effect on learning effectiveness, whereas course difficulty had a negative indirect effect on learning effectiveness. The R^2 value indicates that 46% of the variance in the users' learning effectiveness was explained by their online participation and by perceived usefulness, whereas 39% of the variance in the users' perceived usefulness was explained by perceived ease of use and by course difficulty.

CONCLUSION

During this study, Flickr's screenshot annotations were used to enhance students' learning effectiveness. This method was accompanied by an empirical examination of the effects of course difficulty and online participation, along with factors fundamental to TAM, such as perceived ease of use and perceived usefulness, on learning effectiveness in the context of computer software learning.

As the results show, the students' perceived ease of use and course difficulty were identified as antecedents of perceived usefulness, which had direct and indirect effects on learning effectiveness. The students' perceived usefulness had a positive influence on online participation, which in turn led to learning effectiveness. An important practical implication of our findings is the possibility of improving learning effectiveness in the context of computer software learning by introducing the Flickr platform, which is a great tool for the organization and annotation of information. In fact, Flickr's screenshot annotations can facilitate more practice and cooperative troubleshooting by allowing annotations, including stickers, drawings, and text.

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