Exploring the effect of different usages of technology on the students' using behavior

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BACKGROUND
In recent years, due to the advancement of information and communications technologies (ICTs), various ICTs applications have become popular, and have started to change the ways of teaching and learning. Several studies have been carried out to apply various ICTs such as mobile technologies or collaborative technologies to learning, and further explore the factors that affect students' intention to use ICTs.

PURPOSE
Despite efforts of these earlier works, few explored the effects of different usages of technology on students' using behavior. Specifically, current studies specifically focus on the investigation of one specific usage of a certain technology. For example, Cheung and Vogel (2013) used the technology acceptance model to explore factors that influence the acceptance of Google applications on collaborative learning. The results showed that subjective norms are positively related to students' intention to use Google applications. However, we argue that the different usages of the same technology may result in students' different using behaviors.

METHOD
We constructed a quasi-experimental research design, in which students used Google Docs to collaboratively design the structure of the website. In the experimental group, each student of each group has a desktop computer, so that they can synchronously design the structure of the website through the Google Docs. On the other hand, in the control group, all students of each group only have one desktop computer, that is, they cannot design the structure of the website synchronously.

RESULTS
The results showed that in the control group, attitude toward using is the most important determinant of students' intention to use the technology, followed by perceived ease of use and facilitating conditions. On the other hand, in the experimental group, social influence is the most important determinant of students' intention to use the technology, followed by attitude toward using and perceived ease of use.

CONCLUSIONS
The findings showed that the different usages of technology play an important role in influencing students' intention to use a technology. This suggests that when a technology will be used in education, researchers or teachers should think carefully about how to apply this technology in order to assist students in accept it readily.

KEYWORDS
different usages of technology, intention to use, ICT in student learning, collaborative technologies

Introduction

Information and communications technologies (ICTs) have been viewed as an important tool in education, because they can be used to facilitate students' learning. Early on, some word processing software such as Microsoft Word was used to support students in engaging in collaborative writing (Noël & Robert, 2004). Such tools provide students with the functions of tracking changes and comments, in which the former enables them to examine the changes made by their companions and the latter enables them to provide their companions with comments about on how to revise the article. Later, wiki attracts the attention of many researchers on collaborative learning (Lo, 2009), due to the promotion of Web 2.0 technologies. Wiki is one of web-based collaboration tools, in which it enables users to collaboratively add, revise or delete the content of files through the Internet. Accordingly, wiki is extensively used to help students engage in collaborative learning anytime and anywhere. Recently, researchers have been interested in collaborative services (Pilkington & Sanders, 2014). Such collaborative services such as Google Docs enable multiple users to synchronously edit a shared file online, that is, synchronous collaboration. Accordingly, such services are quite suitable for assisting students in achieving collaborative learning.

Whereas many researchers continuously apply these ICTs to collaborative learning, very little attention has been given specifically to the effect of different usages of technology on the students' using behaviour. An important indicator for successful technologies is based on users' willingness to accept and use it (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Huang, Huang, Huang, & Lin, 2012). Hence, the relationship between technology use and students' intention to use is critical issue, because it is useful to clarify factors affecting students' behavioral intention. Researchers also have indicated that when a technology is used differently in various contexts, it will lead to 'different meanings in different settings' (Peyton & Bruce, 1993, p. 10). Accordingly, understanding the relationship between technology use and students' intention to use is valuable to promote the application of technologies.

In this study, our goal is to use the technology acceptance model (TAM) (Davis, 1989; Davis et al., 1989) and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) to develop a research model and then explore the effect of different usages of technology on the students' using behaviour. Specifically, a quasi-experimental research design was constructed, in which we use Google Docs to implement a traditional collaborative learning context in control group and a modern collaborative learning context in experimental group. Afterwards, a questionnaire based on the research model was used to explore the perspectives of students on the technology. Finally, a series of analyses were carried out to examine students' intention to use the technology and to draw conclusions about the analyses.

Research Design

Research model and hypotheses

Fig. 1 shows the research model, which originates from the combination of TAM and UTAUT. In this study, facilitating conditions and social influence are used as the external variables. The model consists of eight hypotheses, which are described as follows:

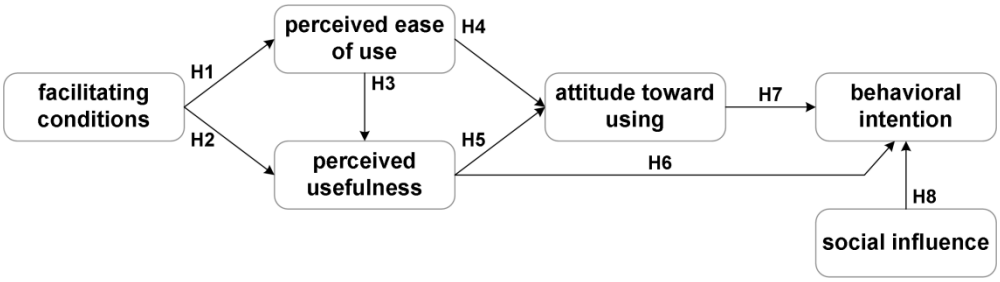


Fig. 1. Research model.

Facilitating conditions refer to "the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system" (Venkatesh et al. 2003, 447-453), such as providing training for new technology or system compatibility. Many studies showed that facilitating conditions affected positively and significantly perceived ease of use and perceived usefulness (Karaali et al. 2011; Rouibah et al. 2009). Karaali et al. (2011) indicated that the perceived ease of use of the technology is affected positively and significantly by providing training for new technology. Rouibah et al. (2009) reported that both the perceived ease of use and the perceived usefulness of a technology are influenced positively and significantly by facilitating conditions such as supporting help during the period of the using the technique. Accordingly, we expect that facilitating conditions are positively associated with perceived ease of use and perceived usefulness, and thus, the first two hypotheses are as follows:

H1. Facilitating conditions are positively related to perceived ease of use.
H2. Facilitating conditions are positively related to perceived usefulness.

Studies of TAM (Davis, 1989; Davis et al., 1989) have revealed that uses intend to accept and use a technology when they perceive that the technology is easy to use and useful to improve their performance. More specifically, when users perceived that a technology is useful, they would find it is easy to use. Afterward, they will hold a positive attitude about the technology after they perceived that technology is easy to use and useful. Finally, users' intention will be influenced by their perception of the technology and their attitude toward the technology (Huang et al., 2012). Consequently, the third to the seventh hypotheses are shown as follows:

H3. Perceived ease of use is positively related to perceived usefulness.
H4. Perceived ease of use is positively related to attitude toward using.
H5. Perceived usefulness is positively related to attitude toward using.
H6. Perceived usefulness is positively related to behavioral intention.
H7. Attitude toward using is positively related to behavioral intention.

Social influence refers to "the degree to which an individual perceives that important others believe he or she should use the new system" (Venkatesh et al. 2003, 447-453), such as the opinions from their friends or teachers. Many studies indicated that social influence affected positively and significantly behavioral intention (Aggelidis & Chatzoglou, 2009; Karaali et al., 2011). For example, Aggelidis and Chatzoglou (2009) revealed that social influence has a positive and significant influence on behavioral intention. Karaali et al. (2011) showed that social influence is positively associated with users' intention to use a web-based learning system. Hence, we expect social influence is positively related to behavioral intention. Therefore, the last hypothesis is formulated as follows.

H8. Social influence is positively related to behavioral intention.

Participants and measurement

The participants were students from two classes in a university in Tainan City, Taiwan. A total of 62 students enrolled in the experiment, in which 26 students participated in control group and 36 students participated in experimental group. A structured questionnaire was developed based on a review of prior studies (Davis et al., 1989; Davis, 1989; Huang et al.,

2012; Teo, 2009; Venkatesh et al., 2003; Venkatesh & Davis, 2000). The questionnaire included six constructs that included facilitating conditions, perceived ease of use, perceived usefulness, attitude toward using, social influence, and behavioral intention. The final questionnaire was distributed to participants, who were asked to indicate their level of agreement with a number of statements on a five-point Likert scale.

Tool of collaboration

In this work, Google Docs was used as a tool of collaboration for supporting students' collaborative learning. Google Docs is a web-based word processing service, in which it not only provides students with the conventional word processing function, but also supplies them with the function of synchronous collaboration (Pilkington & Sanders, 2014). The function enables students to synchronously edit a shared file through the Internet, so that they can exchange their opinions immediately and further accomplish their collaboration.

Experimental procedure

Firstly, all students participated in a course on website design, in which they learned how to design the framework of a website. After the course, these students were asked to practice the design of the framework of websites, as shown in Fig. 2. In order to explore the effect of different usages of technology on the students' using behaviour, we created two different learning contexts, that is, control group and experimental group. In the control group, all students of each group only have one desktop computer, as shown in Fig. 3(a), that is, they cannot design the structure of the website synchronously. In the experimental group, each student of each group has a desktop computer, as shown in Fig. 3(b), so that they can synchronously design the structure of the website through the function of synchronous collaboration of Google Docs. After the students completed the design of the framework of websites, they were asked to fill out the questionnaire that examined the proposed research model.

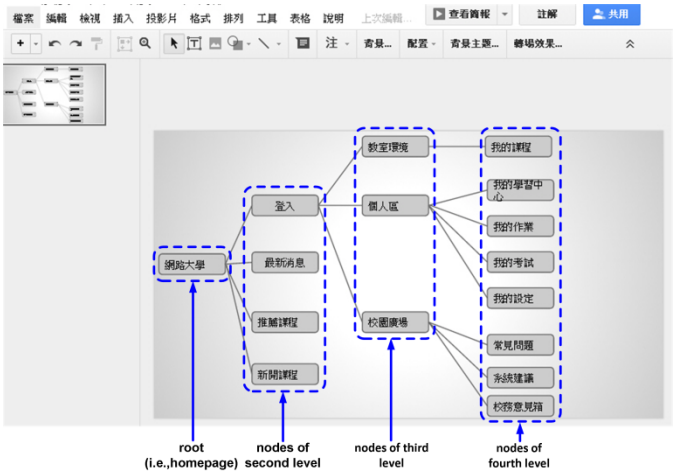
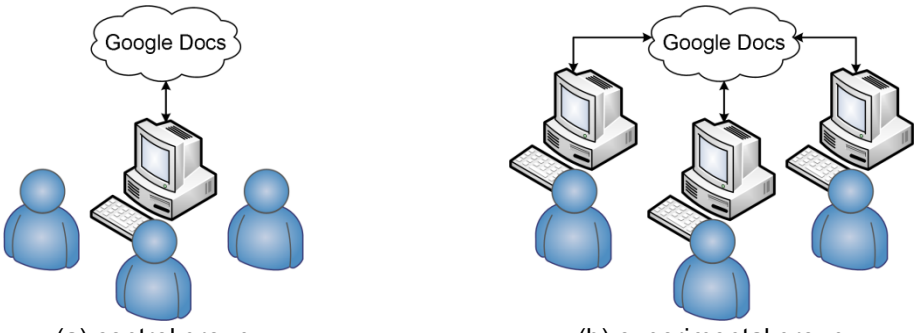


Fig. 2. The framework of a website.



(a) control group (b) experimental group

Fig. 3. Learning contexts.

Results

In this study, the partial least squares approach was used to analyse the data due to a small sample size (minimum sample size=20) (Chin & Newsted, 1999). To this end, SmartPLS 2.0 software package was used to evaluate the measurements and structural models (Ringle, Wende, & Will, 2005).

Measurement model

The reliability of the measures, and the convergent and discriminant validities were used to assess the measurement model. The reliability of the measures was evaluated by composite reliability and Cronbach's alpha, in which the minimum acceptable value of composite reliability is 0.7, and the minimum acceptable value for Cronbach's alpha is 0.6 (Hair, Black, Babin, Anderson, & Tatham, 2006). Convergent validity was verified through the average variance extracted (AVE), in which AVE was required to exceed the minimum threshold of 0.5 (Hair et al., 2006). The discriminant validity was estimated through the square root of the AVE and the latent variable correlations. The square root of the AVE for each construct had to exceed the correlation shared between the examined construct and the others in the model (Fornell & Larcker, 1981). Tables 1 and 2, show that the measurement model is acceptable, since all the values meet the required levels.

Table 1. The reliability of measures and convergent validity of the measurement model.

Construct	Reliability		Convergent validity
	Composite reliability	Cronbach's alpha	AVE
facilitating conditions	0.9	0.8	0.8
perceived ease of use	0.9	0.9	0.8
perceived usefulness	0.9	0.9	0.9
attitude toward using	0.9	0.9	0.8
social influence	0.9	0.9	0.8
behavioral intention	0.9	0.9	0.8

Table 2. The discriminant validity of the measurement model.

	Discriminant validity					
	Latent variable correlations					
Construct	facilitating conditions	perceived ease of use	perceived usefulness	attitude toward using	social influence	behavioral intention
facilitating conditions	0.9					
perceived ease of use	0.8	0.9				
perceived usefulness	0.6	0.6	0.9			
attitude toward using	0.8	0.7	0.6	0.9		
social influence	0.7	0.6	0.7	0.7	0.9	
behavioral intention	0.7	0.6	0.6	0.8	0.8	0.9

Structural model

The path coefficients and R^2 values were used to examine the structural model (Chin & Newsted, 1999). Path coefficients are viewed as the indicator for the statistical significance of these hypotheses. R^2 values were used to evaluate the effectiveness of the model in explaining the variation in the dependent variables.

Fig. 4 shows the result of structural model for control group, in which it indicates that the model explains 76% of the variation in perceived ease of use, 19% of the variation in perceived usefulness, 35% of the variation in attitude toward using, and 62% of the variation in behavioral intention. Fig. 4 also shows the eight path coefficients among the constructs of the model that correspond to the eight hypotheses formulated in this research. First, the path coefficient between facilitating conditions and perceived ease of use is 0.87, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Second, the path coefficient between facilitating conditions and perceived usefulness is -0.13, $p > 0.05$, which indicates that the former did not have a positive and significant influence on the latter. Third, the path coefficient between perceived ease of use and perceived usefulness is 0.55, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Fourth, the path coefficient between perceived ease of use and attitude toward using is 0.36, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Fifth, the path coefficient between perceived usefulness and attitude toward using is 0.33, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Sixth, the path coefficient between perceived usefulness and behavioral intention is -0.15, $p < 0.05$, which indicates that the former did not have a positive and significant influence on the latter. Seventh, the path coefficient between attitude toward using and behavioral intention is 0.74, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Eighth, the path coefficient between social influence and behavioral intention is 0.15, $p > 0.05$, which indicates that the former did not have a positive and significant influence on the latter. These results rejected three hypotheses, namely H2, H6, and H8, while confirmed the others.

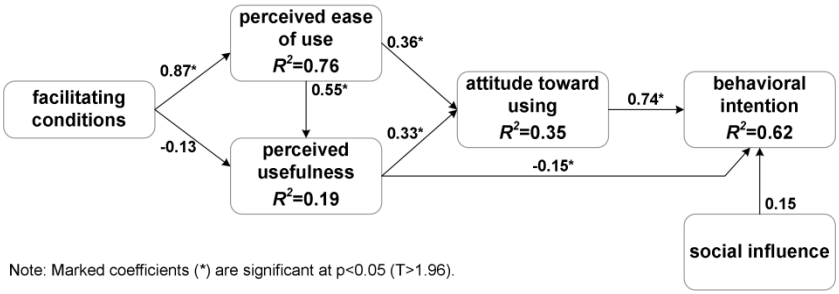


Fig. 4. The results of structural model for control group.

To further explore the factors that affect students' intention to use a collaborative technology for control group, the direct, indirect, and total effects of each construct on behavioral intention are summarized in Table 3. Cohen (1988) indicated that effect sizes with values less than 0.1 are considered small; those between 0.1 and 0.3 are medium, and values of 0.5 or more are large. Table 3 shows most constructs in the research model to have a significant effect on the behavioral intention of subjects to use the collaborative technology. Among these constructs, only attitude toward using is shown to have a large effect size, whereas the other constructs have small or medium effects on behavioral intention to use the technology. Therefore, the dominant determinant of behavioral intention is attitude toward using, with a total effect of 0.74. This is followed by perceived ease of use, and facilitating conditions, with total effects of 0.32, and 0.28, respectively.

Table 3. The direct, indirect and total effects on the intention in using collaborative technology for control group.

Dependent variable	Independent variables	Direct effects	Indirect effects	Total effects
behavioral intention	facilitating conditions	-	0.28	0.28
	perceived ease of use	-	0.32	0.32
	perceived usefulness	-0.15	0.25	0.09
	attitude toward using	0.74	-	0.74
	social influence	non-significant	-	non-significant

Fig. 5 shows the result of structural model for experimental group, in which it indicates that the model explains 76% of the variation in perceived ease of use, 83% of the variation in perceived usefulness, 74% of the variation in attitude toward using, and 86% of the variation in behavioral intention. Fig. 5 also shows the eight path coefficients among the constructs of the model that correspond to the eight hypotheses formulated in this research. First, the path coefficient between facilitating conditions and perceived ease of use is 0.87, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Second, the path coefficient between facilitating conditions and perceived usefulness is -0.67, $p > 0.05$, which indicates that the former has positive and significant influence on the latter. Third, the path coefficient between perceived ease of use and perceived usefulness is 0.26, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Fourth, the path coefficient between perceived ease of use and attitude toward using is 0.74, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Fifth, the path coefficient between perceived usefulness and attitude toward using is 0.13, $p > 0.05$, which indicates that the former did not have a positive and significant influence on the latter. Sixth, the path coefficient between perceived usefulness and behavioral intention is -0.17, $p > 0.05$, which indicates that the former did not have a positive and significant influence on the latter. Seventh, the path coefficient between attitude toward using and behavioral intention is 0.33, $p < 0.05$, which indicates that the former has positive and significant influence on the latter. Eighth, the path coefficient between social influence and behavioral intention is 0.48, $p > 0.05$, which indicates that the former did not have a positive and significant influence on the latter. These results rejected two hypotheses, namely H5 and H6, while confirmed the others.

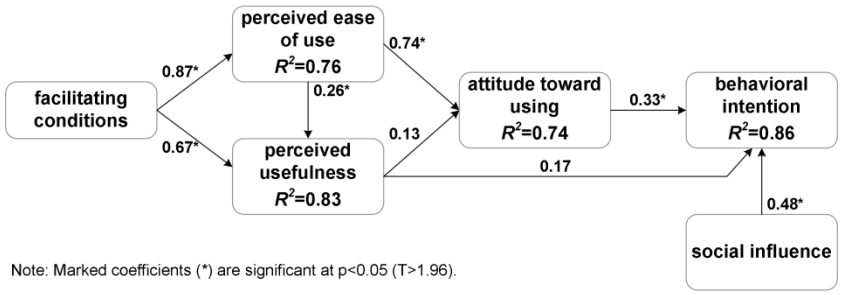


Fig. 5. **The results of structural model for experimental group.**

To further explore the factors that affect students' intention to use a collaborative technology in experimental group, the direct, indirect, and total effects of each construct on behavioral intention are summarized in Table 4, which shows most constructs in the research model to have a significant effect on the behavioral intention of subjects to use the collaborative technology. Among these constructs, only social influence may be viewed as a large effect size, whereas the other constructs have small or medium effects on behavioral intention to use the technology. Therefore, the dominant determinant of behavioral intention is social influence, with a total effect of 0.48. This is followed by attitude toward using, and perceived ease of use, with total effects of 0.33, and 0.25, respectively.

Table 4. The direct, indirect and total effects on the intention in using collaborative technology for experimental group.

Dependent variable	Independent variables	Direct effects	Indirect effects	Total effects
behavioral intention	facilitating conditions	-	0.21	0.21
	perceived ease of use	-	0.25	0.25
	perceived usefulness	non-significant	non-significant	non-significant
	attitude toward using	0.33	-	0.33
	social influence	0.48	-	0.48

Conclusions

TAM and UTAUT are used to develop a model to explore the effect of different usages of technology on the students' using behaviour. Our results showed that (1) when the Google Docs is used with the function of synchronous collaboration, social influence is the most important determinant of student intention to use the technology, followed by attitude toward using and perceived ease of use; (2) when the Google Docs is used without the function of synchronous collaboration, attitude toward using is the most important determinant of student intention to use the technology, followed by perceived ease of use and facilitating conditions. These results imply that researchers or teachers should think carefully about how to apply a technology in order to assist students in accept it readily when the technology will be used in education.

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