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CLOUD COMPUTING TECHNOLOGIES IN WRITING CLASS: FACTORS INFLUENCING STUDENTS' LEARNING EXPERIENCE

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ABSTRACT

The proposed interactive online group within the cloud computing technologies as a main contribution of this paper provides easy and simple access to the cloud-based Software as a Service (SaaS) system and delivers effective educational tools for students and teacher on after-class group writing assignment activities. Therefore, this study addresses the implementation of the most commonly used cloud applications, Google Docs, in a higher education course. The learning environment integrated Google Docs that students are using to develop and deploy writing assignments in between classes has been subjected to learning experience assessment. Using the questionnaire as an instrument to study participants (n=28), the system has provided an effective learning environment in between classes for the students and the instructor to stay connected. Factors influencing students' learning experience based on cloud applications include frequency of interaction online and students' technology experience. Suggestions to cope with challenges regarding the use of them in higher education including the technical issues are also presented. Educators are therefore encouraged to embrace cloud computing technologies as they design the course curriculum in hoping to effectively enrich students' learning.

Keywords: **Cloud computing, Google Docs, user satisfaction, user preference, interaction, learning styles.**

INTRODUCTION

E-Learning is usually understood as instruction delivered through an educational technology in teaching and learning. A wide range of terms are interchangeable with e-learning, including online learning, computer-based learning, web-based learning, virtual learning, digital learning, and so on. In recent years, e-learning appears to be brought about by advances in information technology. These advances indeed have given a rapid and dramatic rise to research and development in cloud computing. Emergence of cloud computing technologies and accessibility of learning, it is expected that more online cloud-based applications will be used in higher education in new generation of e-learning. Study (Deters, Cuthrell, & Stapleton, 2010) describes that educators and students are increasingly adopting many of these cloud computing software services for their projects and assignments. Koh and Lim (2012) also indicated that 64% of students in higher education used online collaboration applications such as Google Docs and Microsoft Office 365 at least several times a month to stay connected with their classmates, to study, and to work on course assignments. The new or the future learners are totally digitalized, also called digital natives, digital immigrants, .net generation, and Generation @ (Oblinger & Oblinger, 2005; Prensky, 2001). Therefore, the need for adequate research in cloud-based learning environments in higher education will be soon necessary. Understanding how students learn with cloud-based applications will be important because it will guide future educators develop a better improvement of course design in cloud learning

environments, making cloud apps more effective in the field of education. This study was conducted to gain a better understanding of how students' characteristics and learner factors impact their learning experience with cloud computing technologies. The results can be shared for future educators to integrate cloud computing apps as a regular part of their instructional practices.

Cloud Computing

The cloud uses software and data stored on the servers in its system. Cloud computing uses the Internet and central remote servers to maintain shared documents, files, software, knowledge, and applications through a cloud-based service that computers or mobile devices can access on demand. The large vendors such as Microsoft, Google, Yahoo, Amazon, and IBM operate and maintain the cloud system. A Service-Level Agreement (SLA) is a term created by the cloud provider. It is a service contract between a cloud provider and the service user that defines the particular aspects of service expected from the service provider, including scope, quality, and responsibilities. Three service models can be summarized (Mell & Grance, 2011; Vaquero, Rodero-Merino, Caceres, & Lindner, 2008). Software as a Service (SaaS) is an operational expense in which the service user uses web-based applications that are provided by the cloud provider. The consumer has no control over the infrastructure, such as Google Docs and Microsoft Office 365. Platform as a Service (PaaS) are on-demand tools from the Internet that develop the computing environment. This allows the service user to develop applications using the provided service, such as Google App Engine or Microsoft Azure. Finally, Infrastructure as a Service (IaaS) is what runs the Internet for the service user. There, the cloud provider allows the users to run virtual machines on their infrastructure, such as Amazon Elastic Compute Cloud and Rackspace.

In general, cloud computing is characterized by resource pooling which allows the users access to data from any computer anytime anywhere, in real time. The data can be presented at one or multiple locations based on service level agreements established between the service provider and user (Katz, 2008).

Cloud Computing for Higher Education

Cloud-computing is already used extensively in higher education for a wide variety of functions including word processing, spreadsheet, presentation, videoconference programs, and e-mail (Lin, Yu, & Wang, 2014; Slahor, 2011). It indeed enhances students' active participation, increases the learning engagement, and enriches their learning process (Parker & Chao, 2007). Cloud computing technologies are free or low-cost for users such as students and teachers to support learning, social interaction, context creation, publishing, and collaboration. A variety of cloud apps do not actually require installing software on the user's computers. Some large software enterprises offer educational editions of cloud based learning management system for free of charge, for example Microsoft (Microsoft, 2015) and Google (Google, 2015). Examples of cloud-based apps include Microsoft Office 365, Dropbox, Google Apps, and YouTube. SLA is one of the characteristics that make cloud computing appealing to educational administrator as it helps to provide access to students for software and apps that are not previously available.

Essentially, cloud computing is beneficial to the learners, school administrators, and educators. Cloud computing affords opportunities for greater student choice in learning. Students can access a wide array of resources and software tools that suit their learning styles and interest using an Internet-connected device. Meanwhile, the increasing ease of access have attracted learners to analyze their data in greater depth with utilization of cloud computing technologies (Susa, 2009). In addition, it is truly beneficial for the educational sectors to use cloud formation with their budget restrictions. Cloud-based service can help schools reduce capital investment costs. More importantly, particularly in higher educational settings, benefits from

conducting collaborative activities in cloud, higher educational professionals therefore meets the necessary requirements in educational contexts, including accessibility and interactivity (Honeycutt & Herring, 2009); immediate feedbacks from peers (Ebner, Lienhardt, Rohs, & Meyer, 2009); motivation and virtual face-to-face discussion with instructors or classmates (Grosseck, & Holotesku, 2008); supports of collaboration (Lin, Yu, & Wang, 2014); learning dynamics (Borau, Ullrish, Feng, & Feng, 2009); and the new generation of learning favor (Jabbour, 2013).

Purposes of the Study and Research Questions

The purposes of the current study are to contribute to the literature on student learning experience using Google Docs cloud application on after-class group writing assignment activities and to assess the learner characteristics factors that influence the students' learning experience. The goal is to gain knowledge regarding how students learn with the cloud computing technologies and how to improve learner satisfaction for further cloud applications implementation. The following research questions were considered.

- What are the students' learning effects by using Google Docs in writing assignment activities?
- What factors influence students' learning experience using Google Docs app on after-class writing assignment activities?
- Which aspect(s) of Google Docs do student users like and/or dislike in an educational setting?

BACKGROUND

Numerous research studies explored different variables that may influence the students' learning experience of e-learning, such as the problems and difficulties they encountered in terms of communications, interactions, and technologies (Hara & Kling, 1999), as well as the level of interaction and learning styles (Moore & Kearsley, 1996). Therefore, understanding how these factors influencing the students' learning experience facilitates the creation of appropriate cloud-based e-learning environments for teaching and learning. Thus, the educators can design and deliver better effective cloud-based instructional activities to the new generation of students.

Technology Tools

Liaw and Huang (2007) list four criteria influencing students' learning satisfaction in an e-learning environment, including environmental characteristics, environmental satisfaction, collaboration activities, and learners' characteristics. Previous study (Sun, et al., 2007) has shown seven factors affecting learners' learning satisfaction in e-learning: (1) learner computer anxiety, (2) instructor attitude toward e-learning, (3) e-learning course flexibility, (4) e-learning course quality, (5) perceived usefulness, (6) perceived ease of use, and (7) diversity in assessments. Several studies (Piccoli et al., 2001; Webster & Hackley, 1997) indicate that technology and Internet quality have great impacts affecting learner satisfaction. Piccoli et al. (2001) addresses that computer anxiety significantly affects learning satisfaction in virtual learning environments. Regarding technology experience, studies have indicated computer skills have little impact affecting the level of learning satisfaction in a virtual classroom (Sturgill, Martin, & Gay, 1999; Swan, et al., 2000). For other learner characteristics factors, research results are rather inconsistent (Kearsley, 2000; Sun et al., 2007; Swan, et al., 2000). Therefore, further research is needed to explore the relationship between learners dimension and learning satisfaction in cyberspace.

Learning Styles

Each individual learns in a different way. Studies have revealed that there is a relationship among learning styles, strategies, and course performance (Curry, 1987; Keefe, 1991; Terell,

2002). Kolb (1985) advocates that the effective learner relies on four different learning modes, Concrete Experience (CE), Abstract Conceptualization (AC), Active Experimentation (AE), and Reflective Observation (RO). Consequently, the following brief description of four basic learning styles is based on four modes (Kolb, 1985). First, convergers are characterized by AC and AE. They are good at problem solving using deductive reasoning. Second, divergers are characterized by CE and RO which has the opposite strengths of the convergers. They are good at brainstorming with their imaginative ability. Third, assimilators are characterized by AC and RO. They are good at planning theoretical models using inductive reasoning. They are less interested in people as the convergers. Last, accommodators are characterized by CE and AE which has the opposite strengths of the assimilators. They are good at actively planning things and learn best from trials and errors, relying heavily on other people for information.

Honey and Mumford (2006) adapted Kolb's learning model and aligned four learning styles named Activist, Reflector, Theorist, and Pragmatist. Kinsella (1995) indicated that learning "styles" is for a general term, being "an individual's natural, habitual, and preferred way of absorbing, processing, and retaining new information and skills" (p. 171). Particularly, in addition to the cognitive domain, learning styles should also contain the affective and physiological domains (Oxford, Hollaway, Horton-Murillo, 1992), and learning strategies (Anderson, 2005; Cohen, 1998; Oxford, 1995). Leaning strategies are the particular mental and communicative process that leaners use to learn (Chamot, 2005).

Other learning styles that might have an impact on web-based learning include, active/reflective, sensing/intuitive, visual/verbal, and sequential/global. Sabry and Baldwin (2003) indicate that sequential/global learning style has a significant relationship with the level of interaction among students in web-based learning environments. Learning style influence how students learn, how teachers teach, and how they interact (Zhou, 2011).

Interactions

Learners learn best when they actively involved in the learning process through social interaction with the immediate learning environment (Vygotsky, 1978; Woo & Reeves, 2008). Research studies suggest that frequent constructive interaction with the instructor and among students in a dynamic communicative learning environment can affect the level of learning success (Doolittle & Hicks, 2003; Swan, et al., 2000). Studies (Wang, 2013; Wang, Yu, & Wu, 2013) have shown that perceived individual accountability and quality of feedback were two important elements in Web-based e-learning environment. Studies (Tsay & Brady, 2010; Biasutti, 2011; Rovai, 2002) also revealed that course interaction has a significant relationship with student performance and satisfaction.

In collaborative language learning, interaction is the key element as a means of identifying quality of learning for improving performance and developing language skills (Dippold, 2009; Lin, Yu, & Wang, 2014; Swan, et al., 2000; Wang, 2013; Wang, Yu, & Wu, 2013). Learning is naturally a social activity that engages interaction with one another.

METHODS

Participants

A total of 28 students enrolled in Business Writing course at a university in central Taiwan. Participants were college senior students who were studying full-time. The majority of the participants were females (82% female & 18% male) with the average age of 22.1 years old. After using the SaaS model for 18-week, particularly Google Docs, the participants were asked to complete an online questionnaire. All 28 students answered the survey and no missing or invalid responses were found on questionnaires.

Regarding students' technical skills, the data showed that most participants considered themselves as experienced users of computers (94%), social networking apps (87%), and e-mail (92%). Indeed, most the participants (88%) felt easy using computer technology. About their learning styles, the majority of the students were divergers (43%) and assimilators (32%) as shown as Table 1. The results of ANOVA indicate that there is no significant differences (p= .05) between the mean ages of the four learning styles of the groups.

Table 1. Participant characteristics

Learning Style	Gender		Total
	Male	Female	
Accommodator	0	4	14%
Diverger	2	10	43%
Assimilator	2	7	32%
Converger	1	2	11%
TOTAL	5	23	100%

Instrument

An online questionnaire was used for collecting students' learning experience of the course. Two categories of questions were included, a quantitative evaluation of specific aspects, and a qualitative evaluation of students' overall comments.

The quantitative evaluation consists of 30 closed questions. Except two demographic questions, all of the item responses were measured with Likert scale. The five sections of closed questions were technology experience, learning style, interaction, user satisfaction, and user preference as shown in Table 2. The Cronbach's α value of reliability in each section ranged from .68 to .85.

Table 2. Quantitative Questionnaire

Sections	# of Items	Sample of Questions	Internal Reliability α
Technology Experience	4	I considered myself as an experienced e-mail user. I felt it's easy using computer technology.	.68
Learning Style	12	When I think about what I did yesterday, I am most likely to get a picture. I prefer to get new information in pictures, diagrams, graphs, or maps.	.76
Interaction	4	We maintain effective interaction working together using Google Docs. I enjoyed talking to my instructor online.	.85
User Satisfaction	4	I am satisfied with using Google Docs functions. I am very satisfied using Google Docs for my group project.	.82
User Preference	4	I prefer using Google Docs to discuss homework with my classmates. I prefer face-to-face to discuss homework with my instructor.	.79

Regarding the qualitative aspects, the participants were invites to provide overall comments of their learning experience. These 2 open-ended questions gave the researcher insights into the effectiveness and ineffectualness of the cloud learning environment.

1. Please indicate which aspects of the writing assignment activities with Google Docs app you like most?

2. **Please indicate which aspects of the writing assignment activities with Google Docs app you dislike most?**

Procedure

This research was conducted in Business Writing class, at a vocational 4-year university in central Taiwan. Students were seniors majoring in Applied Foreign Languages. In the school zone, students can access to free Internet with their student ID numbers to log in; in the off-school zone between the classes, 100% of students have their own mobile data plan allowing them to access to Internet. It is a norm that every of college students in Taiwan has his/her data plan to keep them to access to Internet. In this study, the proposed interactive online group with the cloud-based instruction integrated with Google Docs app provides students simple access to the cloud-based learning SaaS model and delivers interactive tools for students and the professor to discuss between classes. The SaaS model was conducted in Business Writing, one-semester course work which met in two 50-min lecture sessions with a once-a-week. At the beginning of the study, the participants (n= 28) were introduced to the course content and to the cloud learning environment. During the second week of the semester, the students were introduced to the Google Docs app and received an hour-long training session on how to use Google Docs working or co-write a group writing assignment together. Therefore, during the training session, those who did not have a Google Gmail account were asked to create a free Google account in order to open (login to) the Google Docs website. All students were asked to create their first document, save and retrieve the file as they would do on a Microsoft Word application. Then they were taught how to tag and share a document with another reader. Meanwhile, they were given an opportunity to view their peers' document and a permission to edit and co-write the document. A variety of course activities along with the features of Google Docs include reading the assignment instruction or others' document online, editing one's own document or others' work, suggesting or commenting on others' document, and sharing one's own documents. Google Docs app allows access from any computers to collaborate by sharing a document with other users as viewers, collaborators, or by publishing it on the web (Conner, 2008).

In this study, a cloud-based application supported learning environment in between classes was proposed to foster and connect classroom teaching and learning experience. Figure 1 shows the framework of the proposed learning environment consisting of three major components, cloud app, teacher, and student. During the study, each of the students was asked to read the academic materials as different business scenarios in the cloud and was required to write six different writing styles of documents with up to 300 words as his/her individual assignments, including inquiry email letter, requesting email letter, invitation message, concerning payment, memo and fax, and complaint letter. After students were getting more familiar with Google Docs app, at the week five they were assigned a term project, designing a business proposal. The students were highly encouraged to work in groups, using Google Docs to collaborate with whom they gave permission to edit and work with. The focus of this feature was to encourage students to continue their work and share accomplishments after class in the cloud. While working with others, the students also interacted with their instructor regularly in the cloud. The instructor edited the phrases, sentence structures, and posted his comments and shared compliments in this cloud-based learning environment both to their individual and group assignments in between classes. Though Google cloud has a perfect track record, the instructor still recommended his students to store their documents both online and on hard-copy. Upon completion of the writing assignment activities, an email was sent to students inviting them to complete the online questionnaire at the week 18. Participation was voluntary and students were not required to provide any personal information such as name or contact number in the survey.

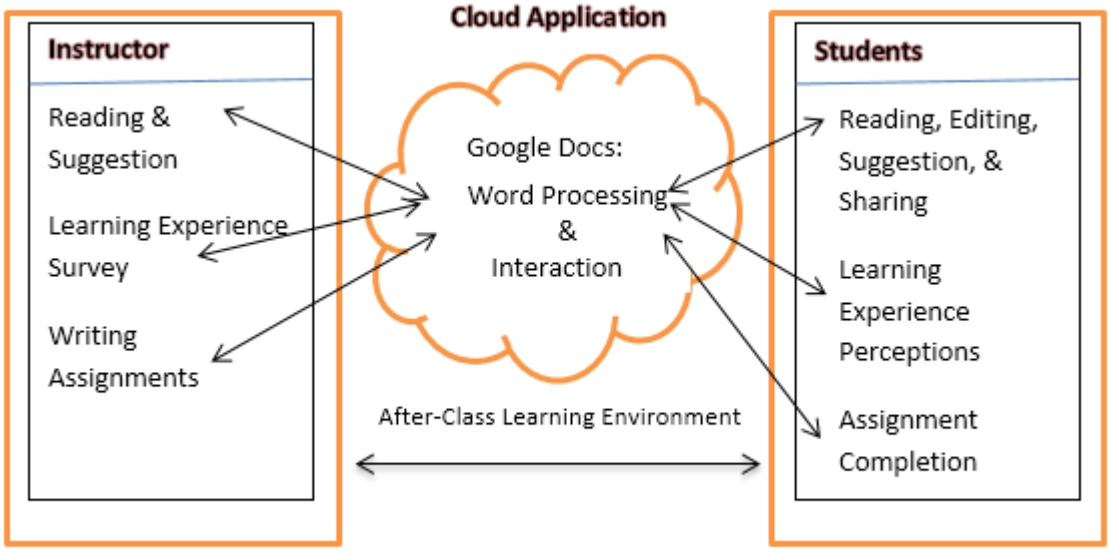

Figure 1. The framework of the cloud app supported learning after class

Writing Assignments: Group Project and Individual Assignments

A group project was a major assignment in this course. Each group was comprised of 3-4 students and required to design a business proposal project. Students were asked to complete the business proposal and submit their group projects within 6 weeks. The mission of group project was to enhance students to learn from each other, and collaborate with others. The group project also provided students with opportunities to recognize how to work with their peers in cloud learning environments. The primary course objective was to encourage students to collaborate with others and provide an easy-to-access data cloud learning tool between classes.

Throughout the semester, students participated in this course were required to complete reading tasks, processes of peer feedback, sharing, editing, and cloud collaborative tasks. A total of 6 individual assignments were assigned and everyone was required to complete and submit his/her homework within 2 weeks. The purpose of these individual assignments was to encourage students to share or obtain suggestions with/from their peers on document editing through the Google Docs cloud-based app.

RESULTS

Research Question 1: Does use of Google Docs app on after-class assignment activities effectively help the participants learn the course content? To answer this research question, the individual assignments that participants carried out during the activities were evaluated. The means (maximum 100) of each assignment were found as shown in Table 3. The first assignment scored 75.46 at the beginning of the cloud-based activities. The last assignment scored 78.43. The results indicate that use of Google Docs app on after-class assignment was effective.

Table 3. Means of individual assignments

Assignment	1	2	3	4	5	6
Mean	75.46	74.01	76.22	77.85	78.52	78.43

Learner Factors

Research Question 2: What factors influence students' learning experience using Google Docs app on after-class writing assignment activities? To answer this question, the principle component analysis was conducted on all learning variables and user characteristics to identify key factors. The analysis yielded three factors with eight values greater than 1.00 (Table 4). Factor 1 related to individual technology experience. Factor 2 related to learning styles and includes accommodator, diverger, assimilator, and converger. Factor 3 related to communication interaction with the instructor and among students. After identifying three learner factors, a multivariate regression was conducted to examine the relationship between the factors and the students' learning experience in the cloud learning environment. User satisfaction and user preference on cloud app or face-to-face were used as criterion variables.

Table 4. Factor analysis of the survey

	Factor 1	Factor 2	Factor 3
Computer experience	.74		
Social Networking apps experience	.89		
E-mail experience	.71		
Internet connection	.81		
Accommodator		.86	
Diverger		.76	
Assimilator		.71	
Converger		.84	
Interaction with instructor			.76
Interaction with students			.86

Regression analysis revealed that three learner factors were predictive of user satisfaction (R^2= 29) and user preferences (R^2= 22) as shown as Table 5.

Table 5. Multivariate regression with three learner factors

	Learning Experience	Sum of Squares	df	*F*	*p*
Factor 1: Technology Experience	User satisfaction	.21	4	11.23	.11
	User preference	.87	4	4.36	< .001***
Factor 2: Learning Styles	User satisfaction	.29	4	4.22	.54
	User preference	.00	4	.00	.88
Factor 3: Interaction	User satisfaction	.54	2	7.87	< .01**
	User preference	.35	2	6.48	< .001***

*** significant at the .001 level

** significant at the .01 level

* significant at the .05 level

Factors Influencing User Satisfaction in a Cloud Learning Environment

Regression analysis revealed that the Interaction (Factor 3) significantly predicted the participants' satisfaction of learning with the cloud-based app (F= 7.87) at the *p*< .01 level. It could be explained that the participants who perceived more communication or interaction opportunities with the instructors and/or among students in groups through the cloud-based apps in this course were more likely to feel the satisfaction of learning in the cloud learning environment.

Factors Influencing User Preference Cloud Learning Environment

Factors Technology Experience (*F*= 4.36, *p*< .001) and Interaction (*F*= 6.48, *p*< .001) significantly predicted the preference of learning in a cloud.

That is, students who received more interaction from the instructor and peers tended to be more likely to prefer cloud learning environment. In addition, those with more technology experience were more likely to prefer cloud learning environment.

Additional Findings

To examine if there is a relationship between particular learner factors and the mean score of user satisfaction and user preference, a correlation matrix test was conducted. Regarding technology experience factors, Pearson's r (p< .05) revealed a significant substantial positive relationship between social networking apps experience and user preference (Pearson's r= .51). The students with more social networking apps experience tended to prefer learning in the cloud. For the interaction related factors, the results revealed that female students tended to be more likely to interact with their peers more frequently than male students (Pearson's r= -318, p< .05). However, in terms of interpretation, it has to be noted that female participants in this study was unbalancedly high (82%).

In addition, to further investigate the relationship between learning styles and user satisfaction, a linear logistic regression analysis was conducted (R^2= 7). Although only 7% of the user satisfaction was explained by the 4 types of learning styles toward the cloud learning environment, results revealed that diverger learning style was a significant factor predicting user satisfaction (F= 6.87, p< .05) with the highest Beta weight (β= .39, p< .05). The rest of the three learning styles did not show any significant Beta weights and thus did not significantly contribute to user satisfaction (Table 6).

Table 6. Multiple regression analysis for variables predicting user satisfaction

Learning Style Factors	B	SEB	β
Converger	-.05	.14	-.05
Diverger	.30	.16	.34*
Assimilator	.00	.17	.00
Accommodator	.15	.16	.14

*p< .0

Open Questions of the Questionnaire

Research Question 3. Which aspect(s) of Google Docs app do you like/dislike? To answer these two open-ended questions, an inductive reasoning based on the constant comparative method was conducted to analyze the qualitative data collected from the two open questions. Inductive method of analysis has been greatly adopted in earlier research examining online music learning (Seddon & Biasutti, 2009, 2011). There, in the current study, the researcher analyzed and categorized the similar data into different phenomenological themes.

After carefully reading the answers several times, 61 and 24 discernibly different answers were scanned and coded for the positive and negative aspects, respectively. The themes and the categories of both the positive and negative aspects to a quantitative table were then completed. In the phenomenological process, five themes emerged regarding the positive aspects, which were interpreted by the researcher as: collaboration, self-expression, technological structure, rapid deployment, and secure environment. Three themes emerged regarding the negative aspects, which were interpreted by the researcher as: peer interaction, technical issue, and unnecessary chat. In the categorization process, the similar answers were sorted together, and 15 categories formed for the positive aspects (Table 7) and 8 for the

negative aspects (Table 8). It has to be noted that 2 participants provide no comments for the positive aspects and 5 participants left no comments for the negative aspects. In addition, for the question about the positive aspects, participants wrote more comments as compared to the few or blank answers for the negative aspects. Table 7 and Table 8 also present the frequency of these answers mentioned by each participant.

Table 7. Qualitative data of the positive aspects of learning experience in iCB activities

	Category	Participant	Frequency %	Total %	Theme
1.	Project collaborating	11	18.03	45.90%	Collaboration
2.	Information sharing	8	13.11		
3.	Interacting	6	9.84		
4.	Knowledge sharing	3	4.92		
5.	Usefulness	5	8.20	13.11%	Self-Expression
6.	Self-advancement	3	4.92		
7.	Ease of use	4	6.56	14.75%	Technological
8	Chatting simultaneously	3	4.92		Structure
9.	Technical support	2	3.28		
10.	Productivity	4	6.56	18.03%	Rapid
11.	Running immediately	3	4.92		Deployment
12.	Fast update	2	3.28		
13.	Punctuality	2	3.28		
14.	Application Reliability	3	4.92	8.20%	Secure Environment
15.	Stable data storage	2	3.28		

Table 8. Qualitative data of the negative aspects of learning experience in iCB activities

	Category	Participant	Frequency %	Total %	Theme
1.	Too much time spent	7	29.17	66.67%	Peer
2.	No common agreement	5	20.81		Interaction
3.	Different levels of participation	4	16.67		
4.	Lose of data	3	12.50	16.67%	Technical
5.	Functional errors	1	4.17		Issues
6.	Distraction	2	8.33	16.67%	Unnecessary
7.	Obligatory use	1	4.17		Chat
8.	No educational function	1	4.17		

Positive Comments

The participants identified many positive aspects of cloud learning environments. Based on the collected comments, five themes were emerged in the phenomenological process, including collaboration, self-expression, technological structure, rapid deployment, and secure environment.

Theme 1. Collaboration: A total of twenty-eight students emphasized how it provides opportunities to work together with their peers. Of the total of 61 positive comments, the participants (45.90%) pointed out that this cloud app is a good tool for interacting with others

(n= 6), sharing information (n= 8), collaborating group project together (n= 11), and sharing knowledge (n= 3).

Theme 2. Self-expression: After all, the participants (13.11%) felt the use of cloud activities is useful (n= 5), and they were glad to have this new learning (n= 3).

Theme 3. Technological structure: Similarly, the participants (14.7%) also valued the technological structure of Google Docs services. Some participants specified that Google Docs is a tool easy to use (n= 4) allowing members to chat simultaneously (n= 3), and it also provides technical support (n= 2) when they encounter some technical problems.

Theme 4. Raid deployment: The participants (18.30%) considered Google Docs' rapid deployment. Four participants noted that Google Doc is productive, running its function immediately (n=3), fast update (n= 2), and no delay or lag (n= 2).

Theme 5. Secure environment: Finally, Regarding the cloud platform, the participants (8.20%) appreciated the secure environment that Google Docs provided for their saved documents, such as reliable (n= 3) and stable data storage (n= 2).

Negative Comments

The participants wrote only 24 comments for the negative aspects. The participants concentrated on three themes, peer interaction, technical issues, and unnecessary chat. First, more than two thirds of the participants (66.67%) were not pleased about their peer interaction. The students complained that some of their group members did not engage their group projects or did not contribute equally to the assignments (n= 4), and group members have no common agreement (n= 5). Seven students (29.17%) even stated that they spent too much time on cloud activities. S7 reported, "with the Google Docs app working on our group project, some people don't even contribute enough, but rely on other people to finish the job". Similarly, S10 stated, "… now some lazy people can have a full excuse having a free ride". S3 commented that "it spent too much time to reach a compromised idea"; students 5 stated that "we just spent too much on chatting".

Examples of the second them of technical related issues included functional errors (n= 1) and lose of data (n= 3). Students (16.67%) indicated that sometimes the editing part is lost when they edit on the same document at the same time with another user. S22 stated, "… I so hate this group project using Google Docs. I cannot find my saved document". For the last theme of unnecessary chat, the participants (16.67%) focused on Google Doc's distracting effects from the chatroom (n= 2), not useful for educational purpose (n=1). S22 stated that "Google Docs app is definitely not a useful tool for education. It is completely a waste of time here using Google Docs to work on a group project." One student was not pleased with the obligatory participation with other students. S13 questioned "why we have to use Google Docs to do our group project? I am not very happy for being forced to use this app".

FINDINGS AND DISCUSSION

The current study provided the participants perceptions of a cloud-based learning SaaS system, cloud collaborative activities in an asynchronous e-learning environment and provided the comments about learning process that occurred during the cloud learning activities. A new perspective in the app of cloud service for the current generation of the students or within the next generation education has made its mark. With regards to the higher means of each writing assignment, the results proved that the system has provided an effective learning environment between and after class for the students and the instructor to stay connected. Thus, the results of the current study support the previous studies (Schneckenberg, Ehlers, &

Adelsberger, 2011; Tsay & Brady, 2010) which found that participants have better learning performance facilitated with cloud-based apps. It can conclude that utilizing cloud computing to enhance students learning performances showed positive results. Furthermore, the students liked the outcomes of their writing assignment activities through the use of cloud computing apps. Therefore, understanding what learning factors influencing students' learning experience with a course is significant for further educators develop an effective curriculum design with cloud-based apps.

Overall, the results indicated that two learning factors should be simultaneously considered in the development of cloud learning environment: frequency of interaction online and students' technology experience. The results found that the frequency of interaction significantly predicted the students' satisfaction of learning in a cloud environment. An interactive communication among students and an interaction between students and the instructor are significantly essential in a virtual learning environment (Woo & Reeves, 2008). With a high frequency of interaction among students and between students and the instructor can help students develop a sense of community with their peers and the instructor, which is consequently leading to higher learning satisfaction with their course (Rovai, 2002). The strong connection between interaction and user satisfaction found in this current study is supported by previous studies (Biasutti, 2011; Doolittle & Hicks, 2003; Swan, et al., 2000; Wang, 2013; Wang, Yu, & Wu, 2013). High frequency of interaction or communication between students and the instructor and among classmates will lead to greater learning satisfaction. Therefore, apparently, it is to suggest that instructors of cloud-based or virtual courses should make an extra effort to create more interaction and encourage student interacting with classmates and the instructor. The more they interact with each other, the more they are satisfied with the course learning.

Although students' preference with Google Docs app and its features can be explained by the level of computer technology experience, other factors also play a fundamental role in ensuring effectiveness in educational settings. First, as noted in results, Google Docs app provides a stable service and secure platform. It is fact that programs running on the cloud computing technologies do not required extensive memory capacity on the computer using them. Second, Google Docs app enables a number of students to simultaneously edit or comment on a document without geographical or temporal limits. It also allows students and instructors share documents with 200 email addresses instantly and securely. With Web 2.0 technology tools, students are given lots of possibilities to interact with each other, work on a project together, edit/modify each other's saved files, and thus increase the effectiveness of instruction (Woo & Reeves, 2008). Third, Google Docs app supports synchronous communication through synchronous chat services during the cloud activities in real time. It therefore fosters students' self-expression from interacting at the same time. More importantly, from the qualitative data, several benefits in collaborative cloud activity participation in a cloud learning environment were specifically found, including fostering team work, computer skills, and development of communication skills which were consistent with previous studies (Blair, 2006; Bottge et al., 2009). Google Docs is a particularly promising tool for after class collaborative assignment.

About learning styles, the results found that most of the students were groups of diverger and assimilating learning styles which was consistent with previous studies (Gurpinar et al., 2010; Robinson, 2002), and that diverger may predict user satisfaction with the cloud-based instruction. The findings were found to be theoretically consistent with the definition of the Kolb learning style model. Based on the Kolb's (1985) learning characteristics, diverger is characteristic of people from liberal arts background that was exactly similar to the sample group in this study. In addition, Diverger possessed the character of Concrete Experience (CE) and Reflective Observation (Kolb, 1985). Therefore, part of the reasons that diveregers was

the significant factor in this study was that students constantly interacted with one another through Google Docs and consequently, they benefited from peer discussion (CE) and instructor's class lectures (RO). However, only 7% of the user satisfaction was explained by the overall learning styles. Loo (2004) found that relationship between learning styles and learning preferences was weak. Therefore, it is possible to conclude that learning styles did not greatly influence user satisfaction in a cloud learning environment.

In addition to these positive impacts found in this study, educators should also focus on potential challenges of Google Docs in an educational setting. Some negative comments about conflicts between group members. If two users are editing the same document and working at the same time, the conflict might occur. In addition, students spent too much time arguing or discussing the projects which left them no common agreement. And perhaps these negative aspects can lead to learning distraction. Regarding the technical issues about lose of data and function errors, it can be explained by the possible limitation for the use of Google Docs. It tow users are editing the same region and working at the same time, the conflict may occur. To solve this problem, the original document owner needs to organize the editing task. Broin and Raftery (2011) also pointed out this problem in their study.

Jabbour (2013) and Wang (2014) advocate that mobile technologies or Web 3.0 has great potentials to be planned and utilized in the next generation of education. Therefore, studies that guide educational researchers how to best use cloud service into classroom should be highly needed. As clarified in this study, students who considered themselves as experienced computer user tended to more likely to prefer cloud based instruction. New generation of students use emails, instant messaging, video conferencing, and various web-based tool to collaborate instead of traditional face-to-face method for group projects (Koch, 2010). Cloud computing is the core technology of the next generation of network computing platform in education which is the basic environment of the future e-learning (Zhu, 2009). Considering the fact that cloud computing and Web 3.0 have rapidly evolved over the last few years, the current study suggests that studies on effectiveness use of mobile cloud apps in educational settings might be critically important. On April 30, 2014, Google launched mobile apps for Google Docs on Android and iOS. Educators need to embrace this trend in technology as they design the course curriculum in hoping to effectively enrich students' talents and expand their skills.

LIMITATIONS

While this study uncovered the learner factors predicting learning experience in a cloud learning environment with Google Docs app on after-class group writing assignment activities, it might be noted this study is one preliminary investigation on cloud-based applications in higher education. This study has some limitations. The first is about validity of the questionnaire instrument that was used in this study. Some items may have directed the participants to favoring cloud-based apps. Another limitation was the sample size. Since the results represent only one small group of students in one college writing class, they cannot be generalized to other populations. All the participants were enrolled in the same class. Therefore, the sample was very homogeneous and may not be representative of all college students. A longitudinal study in larger group size is recommended for more generalizable results. The final limitation is the instructor's characteristics. The high level of teacher engagement with the students after class might be the major contribution for strengthening the connection between students and instructor. The instructor's passion in designing a series of cloud learning activities may enrich and promote teaching and learning environment.

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