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The Crucial Influences of Interpersonal Relationships on Learning Motivation and Performance in a Cloud-based Collaborative Learning Platform

Tzu-Hua HUANG

Department of Education, University of Taipei

Yuan-Chen LIU

Graduate School of Curriculum and Instructional Communication Technology
National Taipei University of Education

Pei-Chun YU

Department of Education, University of Taipei

The interactive functions and personalized services provided by cloud technologies have created new opportunities for students and teachers in learning. As the frequency of communication between teachers and students, among teachers, and among students themselves in the cloud has significantly increased, "interpersonal relationship" emerged as a new topic in the field of e-learning. This study uses a free cloud-based collaborative learning platform of word processing software in the learning process in a computer classroom. The purpose of this study is to discuss and explore the influences of learning motivation and performance when learning in the cloud and in an offline environment. Online word processing software was used to teach a group of fifth graders in a computer class in Taoyuan County, Taiwan. This study found that students taught in a cloud-based learning environment (CLE) performed significantly better than those taught in an offline environment. It is worth mentioning that interpersonal relationships did not affect students' learning motivation in a CLE, but students with better interpersonal relationships showed significantly better learning performance. This study concludes

that CLE is an alternative environment for education, in which the immediate and interactive functions benefited students' learning motivation and performance, while interpersonal relationships affected their learning performance. Hence, giving consideration to students' interpersonal relationships within a curriculum will create higher motivation and better learning performance.

Keywords: cloud-based learning environment (CLE); offline learning environment; interpersonal relationship in the cloud; learning motivation; learning performance

Introduction

Educational reform and innovation have been diversified by the development of network technology. Following the trend of Web 2.0 and the concept of the cloud, many open resource websites allow teachers and learners to edit contents based on their needs and to share information for collaboration. Platforms such as teaching blogs, forums, Flickr, YouTube, Myspace, and Facebook have enabled different users to interact and cooperate on a virtual social network (McCarthy, 2010). Web 2.0 increases the width and depth of network applications as it features user interaction and a bottom-up framework, where users are creators and editors of content (O'Reilly, 2005). Educational technology implementation has become more learner-centered (Reigeluth, 1999). El-Hmoudova (2014) suggested that new technologies and teaching styles can improve the quality of learning, and that it is necessary to provide explicit instructions and learning opportunities. The arrival of the Cloud Era has led to the potential development of a new form of interpersonal relationships in the cloud, and it is impossible to escape from this phenomenon. Many studies have focused on evaluating the online learning status of university students or adults (Cochrane & Bateman, 2010; Lockyer & Patterson, 2008; Xie & Ke, 2011), but very few of them have been on interpersonal interactions of younger learners such as elementary students in a cloud-based learning environment (CLE). Drawn upon the need to explore the differences and effects of CLE and offline learning environment, this study, therefore, investigated potential factors affecting elementary school students' learning performance, learning motivation, and interpersonal relationships in the cloud.

Literature Review

Teaching Applications of Cloud Technology

Cloud technology is a new computing model. It distributes computation tasks in the resource pool, which consists of a large number of computers, so the applications can obtain computation power, storage space, and software services on-demand. This resource pool is known as the "cloud" (Zhang, Yan, & Chen, 2012). For decades, rapid developments in information and communication technologies meant that education has been required to continually adapt to these changes. Cloud technology can be thought of as a device to support learning and teaching models for the 21st century and challenge-based learning (Yoosomboon & Wannapiroon, 2015). According to Jalali, Bouyer, Arasteh, and Moloudi (2013), cloud technology, a new paradigm of distributed computing, presents many new ideas, concepts, principals, technologies and education styles into service-oriented computing. Cloud technology is the core value of the development of CLE; most personalized learning systems are designed for e-learning on personal computers or mobile learning devices (Nedungadi & Raman, 2012). Nedungadi and Raman (2012) developed a cloud-based adaptive learning system by utilizing mobile devices in classrooms. Their participants were 61 K–10 students and the experiment combined formative evaluation with an online learning environment. Results of their study indicated that students could seamlessly adapt or use e-learning and m-learning systems without affecting their learning performance. Teachers could monitor the performance of individuals and groups, and students were very interested in using mobile devices and gained a sense of participation. Lockyer and Patterson (2008), following the development and diffusion of Web 2.0 technology, used Flickr to examine the effects of social network technology on formal learning. The network-based learning course in their study assisted students with the use of information technology for learning on the Internet, validating learning theories, and learning techniques of practical knowledge. Their research results indicated that learners perceived different levels of participation in different themes, and that online courses allowed learners to engage in more in-depth participation and to better understand learning activities with no constraints of time and place. In the application of Wikispaces, the Faculty of Medical and Health Sciences of New Zealand's University of Auckland carried out 16 Educational Technology Professional Development (ETPD) workshops for a two-year study; research results showed that a project-based workshop allowed learners to gain more specialized knowledge and problem-solving abilities, and increased willingness in using it

(Doherty, 2011). The data storage function of cloud technology can extract participants' feedback for analysis; the adaptive and expandable framework increased learners' interest and sense of participation; and the function of powerful link enabled more in-depth participation and better understanding of learning activities. These functions imply that the interaction, joint editing, and data storage of a CLE can be applied in extensive and in-depth educational uses. The latest study on a cloud-based reflective learning environment proved the effectiveness and usefulness of reflection ability to students during and after class. It also facilitated teachers in monitoring and planning under such an environment (Lin, Wen, Jou, & Wu, 2014). In conclusion, the technology of CLE creates more opportunities to engage students in learning tasks, and makes learning remote and flexible.

Interpersonal Relationships and Online Behavior

Heider (1959) defined interpersonal relationship as a kind of relationship between a few groups of people; it includes ideas, expectation, awareness and reaction of an individual to others. Schutz (1960) proposed interpersonal relationship as a need between people; it contains three different levels of needs, namely affection, inclusion and control. Affection refers to the desire of expressing emotions and gaining affection from others; inclusion refers to the hope of an individual of being accepted and recognized; control refers to the desire of an individual to influence people, things, and objectives in certain aspects. Interpersonal relationships in real life emphasize real interaction and shared activities among friends, peers, parents and teachers (Chang, 1998; Y. Z. Chen, 2002). Individuals are driven to develop and continue positive social relationships in order to experience a sense of belongingness (Grieve, Indian, Witteveen, Tolan, & Marrington, 2013). Internet technologies expand users' circle of friendship and improve interpersonal skills, but cannot completely replace real-world human interaction, such as parent-child interaction, friendship and other social connections (Z. Y. Chen, 2000). S. Y. Chen and Macredie (2004) indicated that the variation of interpersonal relationships is one of the crucial factors influencing online teaching process. However, many researchers have pointed out significant drawbacks of using Internet communication (e.g., Internet addition, anti-social or dis-inhibition behavior). They found that heavy users of the Internet tend to experience more intense loneliness and frustration, and their online behavior may reduce interaction in real relationships (King, 1996; Suler, 1996).

With peer support in online environments, students may perform better academically (Cronjé, Adendorff, Meyer, & van Ryneveld, 2006; H. M. Huang, 2000; Lai, 2002; Parks &

Floyd, 1996; Stankiewicz & Garber, 2000). Martin and Dowson (2009) indicated that the roles of interpersonal relationships in students' learning include developing positive interpersonal relationships, bringing healthy physiological functions, bringing happiness, and alleviating stress. Due to the significance and controversy of interpersonal relationships, this study explores how the level of interpersonal relationships in a CLE may influence students' motivation and academic performance. Shana (2009) compared two types of courses: one is taught through traditional teaching methods and the other is implemented through online discussions. The results showed that there is no significant difference in interaction. The user interface of an online environment enables students to clearly communicate with each other without the aid of body language, and the discussion system helps students become more familiar with the course, feel protected, and have higher confidence. J. J. S. Huang, Yang, Huang, and Hsiao (2010) pointed out that users can use non-verbal communication methods (e.g., video, audio and images) provided by social networks, and the communication and sharing functions of these media, which have rich resources, can make their interpersonal relationships even closer. It can be concluded that beyond the disadvantages of Internet behavior, interpersonal relationship has become an important factor in determining positive interaction between students in the learning process.

Interpersonal Relationships in the Cloud and Learning Motivation

Motivation for learning focuses on why learners choose to learn (Pintrich & Schunk, 1996). Wentzel (1999) and Green, Martin, and Marsh (2007) defined "motivation" as a series of interrelated beliefs and emotions that can influence behavior. According to the interactive learning theory, interaction includes interpersonal interaction and interaction between people and teaching materials, which are the basis of learning behavior and student learning (Lou, Wu, Shih, & Tseng, 2010). The social process of motivation and social experience plays a key role in whether a student is academically successful or not (Wentzel, 1999). Relationship intensity was defined as the socially contextualized salience of the human-computer relationship. High relationship intensity indicated that users regarded their relationships with their tablets as more socio-emotionally approximating human-human relationships (Wang & Nelson, 2014). Xie and Ke (2011) used content analysis to examine the discussions of 23 students in an online course, and found that students' learning motivation was the key to whether or not their cooperative learning was successful. De Mooij (1998) and Parks and Floyd (1996) also found that in a collectivistic culture, people tend to attach value to group identity, with a strong tendency to build lifetime

relationships. Piraksa and Srisawasdi (2014) conducted a research using blended combination of hands-on microcomputer-based and computer-simulated laboratory types of inquiry course. The results suggest that a technology-based laboratory environment can significantly improve students' learning motivation.

Shih (2011) used Facebook as a platform to offer a hybrid English writing class, and found that the peer assessment mechanism made the English writing course interesting and effective. Students significantly improved their English writing techniques and knowledge through cooperative learning, and he concluded that the use of Facebook significantly improved students' interest and motivation, which shows the important role of interpersonal relationship in e-learning. Ma and Yuen (2011) set up an Online Knowledge Sharing Model, and pointed out that there is essentially a need to provide learners with "the need to belong" to develop intrinsic motivation in social interaction. Through this model, they linked the association between knowledge sharing behavior and motivation in using it. Davis (2013) found that using the Internet to communicate with friends has a symbolic impact on adolescents' sense of identity. It is evident that the level of online activities may decrease the quality and amount of time spent with friends in person. Another study identified intrinsic and extrinsic motivation factors which helped students to complete Massive Open Online Courses (Tan, Goh, & Sabastian, 2014). It stated the importance of strategies to increase engagement in free online learning platform. Based on the findings above, cloud-based learning is a powerful tool that influences interpersonal relationships in the cloud and learning motivation. Interpersonal interaction is identified as an important factor to increasing learning motivation, and relevant literature has shown that e-learning increases interpersonal interaction and arouses learning motivation. However, there has been relatively less discussion on the correlation between interpersonal relationships in the cloud and learning motivation among elementary students. Therefore, it is necessary to further investigate potential influences of interpersonal relationships in the cloud on learning motivation in a CLE in an elementary educational context.

Interpersonal Relationships in the Cloud and Students' Learning Performance

Psychologists and education researchers have reminded us of the potential negative effects of excessive Internet use, as well as related psychological and physical issues (Rideout, Foehr, & Roberts, 2010). Students today are growing along with computer games and technology, which has changed the form of their leisure, social interaction and

preferences (Bekebrede, Warmelink, & Mayer, 2011). Nonetheless, some researchers presented advantages of collaborative e-learning framework in teaching; it proves that through multi-tier hierarchical online structure and collaborative learning, children's learning experience can be improved significantly (C. M. Chen & Chen, 2014; Kong, 2014; Shorfuzzaman, Alelaiwi, Masud, Hassan, & Hossain, 2015). Furió, González-Gancedo, Juan, Seguí, and Rando (2013) conducted a study on multiculturalism, solidarity and tolerance under the topic of game-based e-learning. Their subjects were 84 children between the ages of 8 and 10. They compared iPhone games with traditional games and found that the children's learning performances were not significantly different. A total of 96% of the children pointed out that they would like to play the iPhone game again, and most of them preferred the iPhone game over the traditional game. Gerber, Grund, and Grote (2008) used distributed cooperative learning activities to examine the influence of communication and cooperation in e-learning plans on learning performance, and found that if the design of e-learning courses allowed space for discussion and interaction, students had better learning performance. The number of messages related to course contents posted by students on the teaching website was close to the number of private messages they had, indicating that interpersonal relationships in the cloud affect students' learning performance. Studies conducted by Kong (2014) and C. M. Chen and Chen (2014) indicated that with the assistance of online learning environment, it certainly boost students' learning performance positively. The former one was planned through 13-week trail teaching with a computer shared by every 3 students, and found that the design of learning in digital classrooms positively assist students' development of information literacy competency and critical thinking skills. The latter one used web interface named CRAS-RAIDS which had significantly improved K5 students' reading performance; particularly, the experimental group had increased better reading attitude and behavior. Li (2014, 2015) reported that the gender factor affected and showed differentiation in interpersonal relationships in an online learning environment. Female students showed more positive attitudes toward learning in an IT environment than male students in a collaborative learning context. Specifically, female students pay more attention to their interpersonal relationships. Whether or not interpersonal relationships derived from cloud-based learning have a similar effect on learning performance has not yet been concluded, but the important role of interpersonal relationships in e-learning is undeniable. Therefore, this study aims to fill the gap of CLE in elementary context for examining the effect of interpersonal relationships in the cloud-based learning platform.

Methods

Participants

Participants of this study were fifth graders in an elementary school in Taoyuan County, Taiwan. Purposive sampling was employed and four classes in the fifth grade were sampled from the elementary school. Two of the classes were randomly selected as the experimental group, which learned in a CLE, and the remaining two classes were the control group, which learned in an "offline learning environment." The numbers of participants in each group are shown in Table 1.

Table 1: Number of Participants in Each Group

Group	Gender		Total
	Male	Female	
Experimental group — CLE	35	23	58
Control group — offline learning environment	35	23	58

Experimental Design

This study uses a quasi-experimental design to examine the effects of a CLE and an offline learning environment on the learning motivation and learning performance of fifth graders. Independent variables are different learning environments; dependent variables are learning motivation and learning performance; control variables are teaching time, information equipment, teaching content, grade, and the teacher's information literacy. The research design is shown in Table 2.

Tools

Cloud-based learning environment (CLE)

The cloud-based teaching software, Think Free Online Beta (http://www.thinkfree.com) is implemented in this study. It is an online word processing software developed by South Korea's Think Free. Its main features include: (a) completely free; (b) sharing and jointly editing files; (c) 1 GB of online disk space; (d) file editing history; (e) issuing blog documents; (f) creating a personal electronic bulletin board; (g) file editing, spreadsheet, and presentation functions; (h) highly compatible with MS Word and supporting Chinese filenames; (i) integrating with the photo album database of Flickr.

Table 2: Research Variables

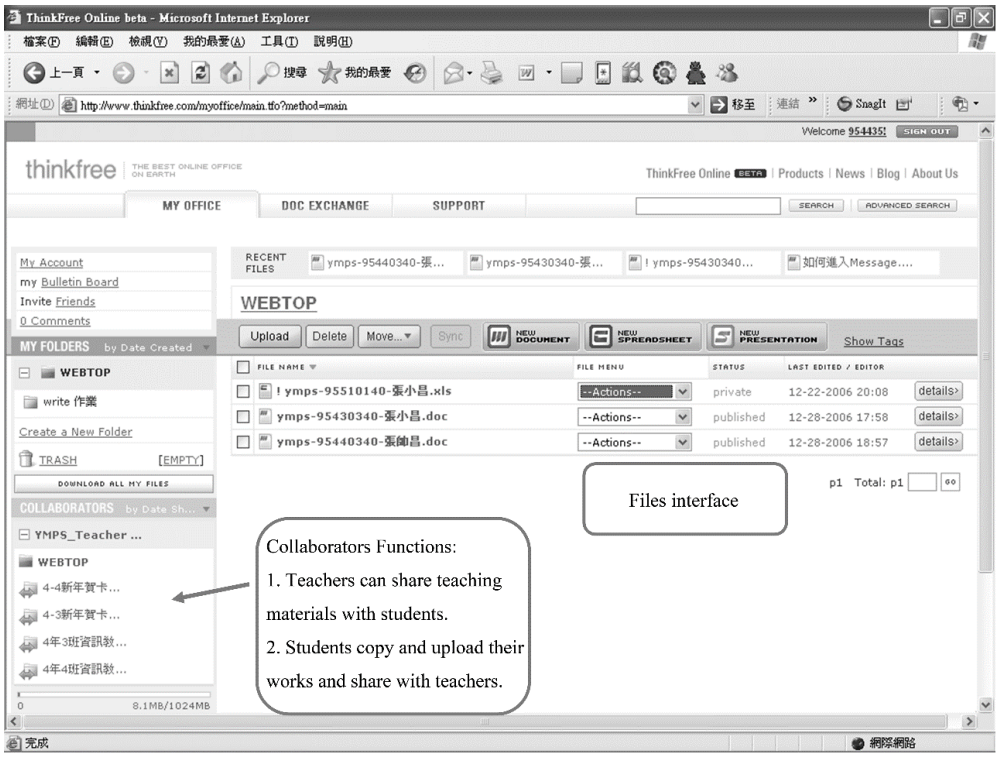
Independent variables	Experimental group: Learns in a CLE. Control group: Learns in an offline learning environment.
Dependent variables	1. Learning motivation: Subjects' score on the motivation scale of the Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich, Smith, Garcia, and McKeachie (1991). 2. Learning performance: Subjects' score in the evaluation of information processing learning performance.
Control variables	1. Teaching time: One 40-minute class a week to a total of 320 minutes over eight weeks. 2. Information equipment: Classes are taught in the same computer classroom and students use the same information equipment. 3. Teaching content: "Information development course plan" and "school-based curriculum children images" for fifth graders, mainly the lessons "Introduction to Excel" and "Beautifying Your Class Schedule." 4. Grade: Fifth graders in an elementary school. 5. Teacher: The teacher of the experimental group and the control group is the same.

The experimental group was set up in a CLE. The teacher first helps students in the experimental group to create an account and password for the cloud-based learning. When students login, they must first update their data and configure the publishing settings, and then they can access learning activities arranged by the teacher. When homework is completed, students can review other students' work and give feedback; revision can be made based on feedback from peers. Once homework is finalized, students can send a message to the teacher. Then the teacher will score the work online and give advice. Students can display all of their works online and deliver presentations in the cloud. The interface of the CLE is shown in Figure 1.

Learning motivation scale

This study uses the motivation scale in the Motivation Strategies for Learning Questionnaire (MSLQ) originally developed by Pintrich, Smith, Garcia, and McKeachie (1991). The scale contains three components: value, expectancy, and affective. The value component includes Intrinsic Goal Orientation (Cronbach α = .74), Extrinsic Goal Orientation (Cronbach α = .62) and Task Value (Cronbach α = .90); the expectancy component includes Control of Learning Beliefs (Cronbach α = .68), Self-efficacy for Learning (Cronbach α = .93) and Performance (Cronbach α = .93); the affective component

Figure 1: Interface of the CLE



includes Test Anxiety (Cronbach α = .80). Each subscale has achieved an acceptable to high level of internal consistency. The scale contains 35 items measured on a 7-point Likert scale. Only Test Anxiety items consist of negative statements. Considering that subjects are elementary school students and not fully mature in emotional development or semantic identification, this study revises the scale into a 5-point Likert scale with five options, namely "strongly agree," "agree," "neither agree nor disagree," "disagree," and "strongly disagree." The positive items are scored as follows: "strongly agree" 5 points, "agree" 4 points, "neither agree nor disagree" 3 points, "disagree" 2 points, and "strongly disagree" 1 point. The negative items are scored as follows: "strongly agree" 1 point, "agree" 2 points, "neither agree nor disagree" 3 points, "disagree" 4 points, and "strongly disagree" 5 points.

Evaluation of information processing learning performance

Evaluation of learning performance is divided into a cognitive assessment and an operating skills assessment. Both assessments include a pretest and posttest to see if there are differences of learning performance in the experimental group and the control group

before and after the experiment. The "cognitive assessment scale" consists of 10 multiple-choice questions based on expert opinions. The "operating skills assessment" was designed according to the objectives of this study, where the teacher first gives students explicit instructions and an example, and then scores each work based on the "work assessment scale," in which the highest score for each item is 5 points and the lowest score is 1 point. The teacher compares the work turned in by students with the example, scores the work on each of the 12 items, and then calculates the total score for each work. Through pretest and posttest, parallel-forms reliability was $r = .81$, representing a relatively high level of internal consistency.

Interpersonal relationship scale

This study uses the "interpersonal relationship scale" designed by Y. Z. Chen (2002) and divides subjects into high-score group (top 27%) and low-score group (bottom 27%). The interpersonal relationship scale has two dimensions: "disclosure of intimacy with online friends" and "disclosure of messages with online friends." The items were measured on a 4-point Likert scale. The scale has a total of 10 items, and subjects answered each item based on the degree it matched their situation, receiving 1 point for "never," 2 points for "rarely," 3 points for "sometimes," and 4 points for "often." The Cronbach α for the two dimensions were .84 and .67, representing relatively high levels of internal consistency. A higher score on the interpersonal relationship scale indicated that the subject was more intimate with online friends.

Results

Analysis of Students' Learning Motivation in a CLE and an Offline Learning Environment

Table 3 displays descriptive statistics for results of the learning motivation scale. In the pretest, the t value of "learning motivation total score" was .768, and the two-tail p value was .444 > .05, not reaching the level of significance. The value of each dimension also did not reach the level of significance, indicating that there was no significant difference in the learning motivation of students in the two groups before the teaching experiment. After the teaching experiment, the t value of "learning motivation total score" was 2.019, and the two-tail p value was .046 < .05, reaching the level of significance. After performing an

Table 3: Independent Samples *t*-test for Learning Motivation in a CLE and an Offline Learning Environment

Dimension	Pretest/ Posttest	Group	*N*	Mean	*SD*	*t*	Significance (Two-tail)
Intrinsic goal orientation	Pretest	Experimental	58	15.83	2.583	–.665	.507
		Control	58	16.14	2.438		
	Posttest	Experimental	58	16.89	2.284	1.335	.185
		Control	58	16.28	2.575		
Extrinsic goal orientation	Pretest	Experimental	58	14.78	3.009	.941	.349
		Control	58	14.26	2.911		
	Posttest	Experimental	58	15.69	2.854	.639	.524
		Control	58	15.34	2.959		
Task value	Pretest	Experimental	58	23.60	4.275	–.338	.736
		Control	58	23.86	3.967		
	Posttest	Experimental	58	25.26	3.702	1.295	.198
		Control	58	24.33	4.032		
Control of learning beliefs	Pretest	Experimental	58	26.34	3.882	.310	.757
		Control	58	26.12	3.908		
	Posttest	Experimental	58	26.74	4.387	.143	.887
		Control	58	26.64	3.360		
Self-efficacy for learning	Pretest	Experimental	58	18.16	3.077	1.842	.068
		Control	58	16.97	3.839		
	Posttest	Experimental	58	20.33	3.097	3.266	.001**
		Control	58	18.21	3.856		
Performance	Pretest	Experimental	58	10.91	1.949	1.621	.108
		Control	58	10.29	2.168		
	Posttest	Experimental	58	12.10	1.997	3.047	.003**
		Control	58	10.88	2.318		
Test anxiety	Pretest	Experimental	58	15.05	3.400	.050	.960
		Control	58	15.02	3.971		
	Posttest	Experimental	58	14.98	4.563	–.229	.819
		Control	58	15.17	4.361		
Learning motivation total score	Pretest	Experimental	58	124.67	14.126	.768	.444
		Control	58	122.66	14.159		
	Posttest	Experimental	58	132.00	13.030	2.019	.046*
		Control	58	126.86	14.348		

* $p < .05$; ** $p < .01$

independent sample *t* test on the dimensions of learning motivation, the *p* values of "self-efficacy for learning" and "performance" were .001 and .003, both reaching the level of significance. It shows that a significant difference between students' learning motivation in a CLE and an offline learning environment is pinpointed.

Students in a CLE had significantly higher learning motivation than students in an offline learning environment. During the course, the teacher found that students were interested and willing to try using the CLE, in which students of the experimental group were the most interested in being able to see the work of their peers. Students of the experimental group did their best in order to present their best work. It is worth mentioning that "self-efficacy for learning" and "performance" reached the level of significance in the posttest. "Self-efficacy for learning" refers to individuals' judgments of their abilities to plan and carry out the necessary behaviors to achieve specific goals. Students of the experimental group constantly asked the teacher about production techniques, and it is apparent that they have higher motivation to demonstrate their best work. Linnenbrink and Pintrich (2002) pointed out that adaptive self-efficacy beliefs can function as enablers of academic success. Learners with high self-efficacy are likely to employ adaptive self-regulatory learning strategies and study skills. "Performance" refers to students' belief in their ability to successfully complete a learning task, to continuously refine their work based on feedback from peers; it also refers to every adjustment they make to increase their confidence that they will be successful. This result is consistent with the study by Polat, Mancilla, and Mahalingappa (2013), who stated that learning motivation is closely related to whether or not students actively participate in discussions and interact with other students. Hence, "self-efficacy for learning," "performance," and "learning motivation total score" in Table 3 reached the level of significance in the posttest.

Analysis of Students' Learning Performance in a CLE and an Offline Learning Environment

Table 4 shows another two dimensions of assessments for the results of learning performance. In terms of learning performance, the *t* value of the pretest for "cognitive assessment" was .768 and the two-tail *p* value was .444 > .05, not reaching the level of significance; the *t* value of the pretest for "operating skills assessment" was 1.971 and the two-tail *p* value was .051 > .05, also not reaching the level of significance, showing that there was no significant difference in the learning performance of the two groups before the

Table 4: Independent Samples *t*-test for Learning Performance in a CLE and an Offline Learning Environment

Dimension	Pretest/ Posttest	Group	*N*	Mean	*SD*	*t*	Significance (Two-tail)
Cognitive assessment	Pretest	Experimental	58	124.67	14.126	.768	.444
		Control	58	122.66	14.159		
	Posttest	Experimental	58	75.86	18.452	8.345	.000***
		Control	58	50.52	13.945		
Operating skills assessment	Pretest	Experimental	58	31.55	18.713	1.971	.051
		Control	58	25.52	13.914		
	Posttest	Experimental	58	56.21	7.232	4.789	.000***
		Control	58	45.93	14.654		

*** $p < .001$

teaching experiment. After the teaching experiment, the *t* value for the "cognitive assessment" was 8.345 and $p = .000 < .05$; the *t* value for the "operating skills assessment" was 4.789 and $p = .000 < .05$, showing that there was a significant difference in the learning performance of students in a CLE and an offline learning environment. The CLE allowed students to continue their work online at home. Students could also use the sharing function to see the work of other students, or receive feedback from their peers regarding how to improve their own work. The *t* value was positive in this study, meaning that the learning performance of students in a CLE was significantly higher than students in an offline learning environment. Heo and Chow (2005) found that a well-designed online learning environment can improve students' learning performance, especially when the learning tools have interaction, sharing and feedback functions. From the results, it can be concluded that the CLE has file sharing, feedback and online rating functions, and can thus improve the learning performance of students in the experimental group.

Learning Motivation and Learning Performance of Students With Different Interpersonal Relationships in the Cloud

To examine if interpersonal relationship in a CLE affects learning, this study further analyzes the effects of good (high-score group) and poor (low-score group) interpersonal relationships in the cloud on learning motivation and learning performance of students in the experimental group. Interactions in a CLE form interpersonal relationships in the cloud, while operations and learning in an offline learning environment are all interpersonal interactions in the real world. Therefore, this study only examines the effects of

interpersonal relationships on learning motivation and learning performance. Students in the experimental group are divided into a high-score group (top 27%) and low-score group (bottom 27%) based on their scores in the "interpersonal relationship scale" of Y. Z. Chen (2002). In other words, after the 58 students are ranked by their score, the top 16 students are the high-score group and the last 16 students are the low-score group.

Learning motivation of students with different interpersonal relationships in the cloud

Table 5 shows the results of learning motivation of students with different interpersonal relationships in the cloud. The *t* value for learning motivation of students with good (high-score group) and poor (low-score group) interpersonal relationships in the cloud before the experiment was 1.15, and the two-tail *p* value (.26) did not reach the level of significance. This means that there was not any significant difference between the learning motivation of students with good (high-score group) and poor (low-score group) interpersonal relationships in the cloud before learning in a CLE. The learning motivation assessment was administered again after the course ended, and an independent sample *t* test was performed on the high-score group and low-score group; the *t* value was .06 and the two-tail *p* value (.95) did not reach the level of significance. This means that there was not any significant difference in the learning motivation of the high-score group and low-score group after the teaching experiment.

Table 5: Independent Samples *t*-test for Learning Motivation of Students with Different Interpersonal Relationships in the Cloud

	Group	*n*	Mean	*SD*	*t*	Significance (Two-tail)
Pretest	Experimental — High-score group	16	126.79	13.86	1.15	.26
	Experimental — Low-score group	16	122.55	14.31		
Posttest	Experimental — High-score group	16	132.10	13.29	.06	.95
	Experimental — Low-score group	16	131.90	13.00		

Table 6 summarizes the results of learning motivation of different interpersonal relationships by groups. The average score for learning motivation of all students in the experimental group was 124.67 points in the pretest, and improved to 132.00 points in the posttest; the *t* value was −4.54 and the *p* value was .000 < .001. This means that students' learning motivation significantly improved after learning in a CLE. This study further breaks

Table 6: Summary of Independent Samples *t*-test Results for Learning Motivation of Students with Different Interpersonal Relationships in the Cloud

Group	*n*	Pretest/ Posttest	Mean	*SD*	*t*	Significance (Two-tail)
Experimental group	58	Pretest	124.67	12.13	−4.54	.000***
		Posttest	132.00	13.03		
High-score group	16	Pretest	126.79	13.86	−2.44	.021*
		Posttest	132.10	13.29		
Low-score group	16	Pretest	122.55	14.31	−3.96	.000***
		Posttest	131.90	13.00		

* $p < .05$; *** $p < .001$

down the learning motivation of students with different interpersonal relationships in the cloud after learning in a CLE, and found that the average score for learning motivation of students with good interpersonal relationships in the cloud (high-score group) was 126.79 points in the pretest and improved to 132.10 points in the posttest; a paired *t* test was performed and found the *t* value at –2.44 and the *p* value at .021 < .05. This means that the learning motivation of students with good interpersonal relationships in the cloud (high-score group) significantly improved after learning in a CLE. The average score for learning motivation of students with poor interpersonal relationships in the cloud (low-score group) was 122.55 points in the pretest and improved to 131.90 points in the posttest; a paired *t* test was performed and found the *t* value at –3.96 and the *p* value at .000 < .001. This means that the learning motivation of students with poor interpersonal relationships in the cloud (low-score group) also significantly improved after learning in a CLE.

The file sharing and feedback functions of the CLE used by the experimental group allows students to share and discuss their work in the cloud. Students can revise their work based on the opinions of the teacher and other students, and also give feedback to and interact with other students in the CLE. Most importantly, these actions are not limited to classes, and students can continue to revise their work and interact with the teacher and other students after going home, building interpersonal relationships in the cloud through these interactions online. As shown in Table 5, there was no significant difference in learning motivation between students in the high-score group and low-score group in the posttest. However, as shown in Table 6, the learning motivation of students in both the high-score and low-score group significantly increased after learning in a CLE, indicating that a CLE can help improve students' learning motivation, regardless of their interpersonal relationship. Thomas (2011) reported that meaningful interpersonal relationships can be formed through

online interactions, especially chatting, and that this relationship will increase people's intention to participate in Internet activities, which is consistent with the result of this study.

Learning performance of students with different interpersonal relationships in the cloud

Table 7 summarizes the results of learning performance of students with different interpersonal relationships by groups. The *t* value for "learning performance" of students with good (high-score group) and poor (low-score group) interpersonal relationships in the cloud before the experiment was at 1.49 and the two-tail *p* value (.142) did not reach the level of significance. This means that there was no significant difference in the learning performance of students in the high-score group and the low-score group before learning in a CLE. The learning performance assessment was immediately administered after the course ended, and an independent sample *t* test was performed on the high-score group and the low-score group, in which the *t* value was 2.37 and the two-tail *p* value was .021 < .05. The results of learning performance of students with good interpersonal relationships in the cloud (high-score group) before the experiment was 35.17 while the posttest score was 81.38. As regards the learning performance of students with low interpersonal relationships in the cloud (low-score group), the pretest score was 27.93 and the posttest score was 70.35. Both groups showed significant improvement. This suggests that after the experimental group learned in a CLE, the learning performance of students with good interpersonal relationships in the cloud was significantly better than students with poor interpersonal relationships in the cloud.

Students in higher grades in elementary school care a lot about their performance with peers, and will put extra effort into their work to attract the attention of their peers. Students with good interpersonal relationships in the cloud (high-score group) are more prone to

Table 7: Independent Samples *t*-test for Learning Performance of Students With Different Interpersonal Relationships in the Cloud

	Group	*n*	Mean	*SD*	*t*	Significance (Two-tail)
Pretest	Experimental — High score group	16	35.17	19.57	1.49	.142
	Experimental — Low score group	16	27.93	17.40		
Posttest	Experimental — High score group	16	81.38	14.07	2.37	.021*
	Experimental — Low score group	16	70.35	20.79		

* $p < .05$

accept the advice and encouragement from their peers, and continuously revise and beautify their work; when they encounter issues, they are willing to discuss how to resolve the issue with the teacher and other students. Hence, CLE benefits students with good interpersonal relationships in the cloud, and they also have better learning performance. Cronjé et al. (2006) found that peer support is an important factor to students' learning performance in an online learning environment, and emotional support from their peers makes them more willing to stay online and actively learn. Cleveland-Innes and Ally (2007) pointed out that social interaction, perceptions and sentiment expression are related in an online setting; if students have an affective objective during e-learning, their social skills will enable them to gain successful learning experiences and results. These are consistent with the result of this study.

Learning motivation triggers powerful motive force and learning performance is generally influenced by learning motivation (Slavin, 2008). Among potential factors, the needs and satisfaction of interpersonal relationships are essential incentives that promote learning performance and learning motivation in order to reach learning goals. In a traditional learning environment, competition was the genuine goal; following the rapid development of high technology, learning became remote and unconfined in educational fields. Learning performance has turned its role to person-to-person interaction and collaboration (Y. C. Chen & Huang, 2005). Corresponding to the findings of this study, it is apparent that the connections among interpersonal relationship, learning performance and learning motivation are closely related.

Conclusion

This study was conducted in a computer class of an elementary school in Taoyuan County, Taiwan using online word processing software, and examined the differences in fifth graders' learning motivation and learning performance after learning in a CLE and an offline learning environment. It further examined the differences in learning motivation and learning performance of students with different interpersonal relationships. Results have shown that interpersonal relationships should be considered and implemented in teaching, and significant improvement in learning motivation and learning performance among students were found. Important findings are summarized as follows. Firstly, the learning motivation and performance of students who learned in a CLE were significantly better than students who learned in an offline learning environment. The file storage, data editing,

message sending, file sharing, feedback, and online rating functions of the CLE can effectively improve students' learning motivation and learning performance. Secondly, there was no significant difference in the learning motivation between students with good (high-score group) and poor (low-score group) interpersonal relationships in the cloud in the pretest. However, students in both groups scored significantly higher in the posttest for learning motivation. This may indicate that learning in a CLE improved students' learning motivation, regardless of their interpersonal relationships. Finally, learning performance was significantly different between students with good (high-score group) and poor (low-score group) interpersonal relationships in the cloud, in which the high-score group was significantly better than students in the low-score group. This shows that interpersonal relationships in the cloud affect students' learning performance in a CLE. The CLE allows students to upload and share their files, and students can revise and modify their work based on interactions with the teacher and their peers, which improves learning performance of students with good interpersonal relationships.

Other potential factors such as learning strategy, learning anxiety and learning atmosphere should be considered for future CLE studies in order to understand the differentiation of interpersonal relationships and learning performance. The results of the study may not be applicable to other contexts in terms of influential factors for online and offline learning environments particularly with elementary students. Overall, CLE has advantages for teachers and administrators. Applying cloud computing technology, it is more reliable, cost-saving, remote and convenient to upload and download information with mobile devices. Files are secured and can be shared with different counterparts. Teaching and learning can be delivered beyond traditional setting and trigger higher motivation and positive interpersonal relationships in the cloud. Educators will save more time on managing teaching materials; they will be able to focus on designing teaching materials to provide a better and more effective learning experience. With all the benefits of CLE, students may have a different experience from this study. Teachers can work at any location and use shared online data with all kinds of devices. This increases the frequency of communication between teachers and students, and will eventually change the way of learning and teaching.

CLE is a new option for education, and its immediacy and interactive characteristics improve students' learning motivation and learning performance. It has formed a new paradigm of learning, and CLE and interpersonal relationships are now hot topics in the field of education. Besides learning in school, students can learn anywhere with Internet access after leaving the classroom, making learning more efficient. This study found that in a CLE,

good or poor interpersonal relationships in the cloud do not affect learning motivation, but they do affect learning performance. In conclusion, CLE can help students to become highly motivated, regardless of individual interpersonal relationships in the cloud; students with good interpersonal relationships in the cloud will show a significant improvement in learning performance. Following the arrival of the cloud era, education departments should further explore the positive effects of interpersonal relationships in the cloud, so as to achieve adaptive learning and comprehensive improvements. Education technology is not a myth, but a solid and elaborate e-learning platform based on in-depth analysis, transforming and blending learning into daily life, so that learners can efficiently learn in the cloud.

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雲端合作學習平台中的人際關係是影響學習動機與學習成效的重要因素

黃思華、劉遠楨、余沛錞

摘 要

雲端科技的互動功能與個人化服務開啟了學習的新契機，使得教師與學生、教師與教師、學生與學生在雲端上溝通互動的情形愈來愈頻繁，網路人際關係因而成為數位學習的新興議題。本研究以免費雲端合作學習平台中的文書處理軟體進行電腦科教學，探討台灣桃園市某國小五年級學童經過雲端學習環境與單機學習環境的教學後，學習動機與學習成效上的差異，更進一步探討雲端學習環境中不同網路人際關係的學童在學習動機與學習成效上的差異。研究結果發現，實驗組的學童經過雲端學習環境學習後，學習動機與學習成效均顯著優於單機學習環境的學童；然而，實驗組雲端學習環境中，網路人際關係的高低對學習動機沒有影響，但是網路人際關係高分組學童的學習成效顯著優於網路人際關係低分組的學童。因此，本研究建議，教師在教學時，若能將學生網路人際關係的高、低一併納入思考，基於適性發展的原則，會使學生在學習上有更強的學習動機，進而得到更佳的學習成效。

關鍵詞：雲端學習環境；單機學習環境；網路人際關係；學習動機；學習成效