A Computerized Concept Map Approach to Conducting Peer Tutoring Activities for a Social Science Course

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Abstract

In this study, a concept map approach is proposed for conducting web-based peer tutoring activities for improving the students' learning performance of a social science course. A five-week experiment was been conducted with two classes in Tainan City. The participants are divided into two groups. The experimental group consists of thirty three students provided with a computerized concept map learning model based on peer tutoring, whereas the control group consists of thirty two students provided with a computerized concept map learning model based on independent learning strategy. It was found that the learning achievements of the students who learned with the peer tutoring strategy were significantly better than those of the students who learned with the conventional computerized concept map approach.

1. Introduction

In social science courses, it is important to help students construct holistic concept. If the learning content has contextual meaning, it would be easier for learners to memorize, comprehend and integrate to their cognitive structure, so that they can become part of their holistic knowledge system. More importantly, if learner can develop integrated abilities, they can avoid repeated learning and save more time and energy. Education today also emphasizes the combination and integration of different subjects, among which improving learning achievement by information technology has been recognized as an important methodology in recent years [1].

Social science is an interdisciplinary subject, which needs to integrate different learning domains of theories and principles, so that students can apply them to daily life. Since most teachers tend to instruct by lectures, they fail to have varieties of teaching methods during the class, so them they can't implicit students' learning interest. In this case, cognitive objectives at low level can be obtained while those at high level and effective, instrumental [2] are ignored. Therefore, they have difficulty constructing complete knowledge system.

For this problem, many research argued that concept map can effectively help student to organize and construct their knowledge [3] [4]. Recently, computerized concept mapping has been applied to different subjects, and have satisfactory effect [5] [6]. However, some research indicates that drawing concept map is very difficult for some students [7]. Therefore, how to provide effective concept map strategy to improve students learning achievement is a very important issue.

Many studies indicate that one to one guidance is an effective teaching model [8]. Limited to number of teacher, however, how to use peer tutoring achieve one to one's effective instruct is an important issue. Through the process of peer tutoring student can acquire more practice, immediate feedback and appreciation. Use peer tutoring can overcome the limited number of teacher. In the peer tutoring, through the reflection and reiteration, tutor have better learning achievement than tutee. The tutor role sufficient tends to acquire more concepts and more cognition than the tutee. In the learning process, thinking can help the tutor to clarify abstract concept [9] [10]. Chen et.al (2009) indicated learning by peer discussion and observation is an effective way to improve high level cognitive thinking [11]. By the interaction with peer can provide learning opportunities and positive experiences, which help students learning and increase social ability [12].

Therefore, this study aims to use peer tutoring to improve the learning achievement of computerized concept mapping. Meanwhile, research questions are formulated as follows:

(1)   What are the effects of the concept map-based peer tutoring approach on the students' learning achievement in a social science course?

(2)   What are the effects of the concept map-based peer tutoring approach on the students' learning attitude in a social science course?

(3)   What are the perceived usefulness, perceived ease of use, and satisfaction of the concept map-based peer tutoring learning approach?

2. Literature Review

2.1. Concept Mapping

Concept mapping was proposed by researchers at Cornell University for representing conceptual knowledge structures [13] [14] [15]. Via qualitative and quantitative studies, researchers have shown that concept maps can promote meaningful learning, which leads to positive effects on students [7] [16]. Moreover, concept maps can also be a visualized cognitive tool that helps students organize their knowledge and learning experiences, so that their self-awareness can be improved through reflective thinking [3] [17].

Owing to the advancement and popularity of computer technologies, computerized concept map tools have been wildly used by researches in conducting learning activities for various courses. For example, Kao, Lin, and Sun (2008) indicated that concept mapping can be used in combination with any subject by expressing the domain knowledge in the concept map format to assist students in elaborating concepts, engaging in reflective thinking, or breaking concept boundaries [17]. Liu, Chen, and Chang (2010) employed computer-assisted concept mapping system to help EFL college learners' in improving their English reading comprehension [5]. They found that the computer-assisted concept mapping learning strategy had greater reading benefit for the low-level group than for the high-level group. Hwang, Shi, and Chu (2011) proposed a concept map-oriented Mindtool for collaborative ubiquitous learning [3]. They found experimental results from a natural science course in an elementary school show that this approach not only enhances learning motivation but also improves the learning achievements of the students. Hwang, Wu, and Ke (2011) further proposed an interactive concept map-oriented approach for supporting mobile learning activities [7]. It was found that the proposed approach not only enhances learning attitudes, but also improves the learning achievements of the students.

2.2. Peer tutoring

Peer tutoring is a form of peer-assisted learning (PAL). I'm like most PAL processes (e.g. cooperative group work), peer tutoring involves the creation of pairs of pupils with an asymmetrical relationship - one more knowledgeable individual supporting the learning of a less-knowledgeable partner [18].

Various studies of peer tutoring have demonstrated the effectiveness of this approach. For example, Nath and Ross (2001) examined the effects of peer-tutoring training on elementary school student communication and collaboration skills when used in conjunction with cooperative learning [19]. They found that, the training group surpassed the control group in both communication and collaborative skills; in particular, those in grades 2–3. Recently, Chen, Wei, Wu, and Uden (2009) explored how high level prompts and peer assessment can affect a learner's reflection levels in an online learning context [11]. They found that the main factor affecting reflection levels was high level prompts followed by high quality observation that had a moderating effect on learners' reflection levels. Furthermore, De Smet, Van Keer, De Wever, and Valcke (2010) conducted an authentic university setting with fourth-year Educational Sciences' students operating as online peer tutors to facilitate freshman tutees' online collaboration and knowledge construction in a blended ''Instructional Sciences'' course [12]. They examined the impact of three tutor training conditions (multidimensional support, model/coach, and control condition) on peer tutors' actual tutor behavior in asynchronous discussion groups and on tutors' self-efficacy beliefs, perceived collective efficacy, and training evaluation. The experimental results showed that an explicit tutor training appears to determine the adoption of the expected types of tutoring activities; that is, providing novice peer tutors with guidelines by means of a specific training is fruitful for realizing more adequate online tutoring behavior and optimizing self-efficacy beliefs regarding tutoring competences.

3. Research method

3.1. Participants

The subjects included two classes of fifth graders in an elementary school in Tainan County, Taiwan. A total of sixty-five students voluntarily participated in the study. One class was assigned to be the experimental group and the other was the control group. The experimental group, including thirty-three students, was guided by concept map-based peer tutoring learning approach, while the control group with thirty-two students was guided by individual computerized concept map. All of the students were taught by the same instructor who had taught that social science course for more than ten years.

The control group learned individually with computerized concept mapping strategy, and every learner had a computer. The experimental group learned with the peer tutoring strategy using a computerized concept mapping system. They are ranked by midterm scores on social science with the special student deducted, the total of experimental group is thirty-three students. They are paired in the following way. No. 1 student tutor No. 17 student, No. 2 student tutor No. 18 student, and so on. Therefore, there are sixteen pairs in total, with the exception that No. 1 student was also tutoring No. 33.

3.2. Research tools

The research tools in this study included the learning attitude questionnaire for measuring students' learning attitudes toward the social science course, and the pre- and post- tests for evaluating the prior knowledge and the learning achievement of the students before and after the learning activity.

The learning attitude questionnaire was modified from the learning attitude measure developed by Hsu (2008) [20]. It consisted of 10 items with a six-point rating scheme. The Cronbach's alpha value of the questionnaire was 0.75.

The post-test was developed by three experienced teachers with the assistance of an educational researcher. The test contained 45 multiple-choice items categorized by Bloom's (1956) cognitive taxonomy of learning objectives, including three items for the knowledge dimension, fifteen items for the comprehension dimension, five items for the application dimension, thirteen items for the analysis dimension, seven items for the synthesis dimension, and two items for the evaluation dimension [21].

3.3. Experiment Procedure

The procedure of the experiment, before the learning activity, the students who played the role of tutors received a 160 minute orientation, so that they could fully understand their responsibility in assisting their peers. In addition, the tutors were trained to instruct by means of assigning homework and giving feedback to assist the tutees to fully comprehend the learning content.

At the beginning of the learning activity, all of the students took the pre-questionnaire. During the learning activity, the students in the experimental group learned with the concept map-based peer tutoring approach on the Moodle learning platform, which was used to facilitate the instructions and discussions between the tutors and the tutees; moreover, the whole peer tutoring process and the feedback from the tutees were record on the platform to help the tutors improve their instructional strategies. On the other hand, those in the control group learned with conventional computerized concept map approach

individually. After the learning activity, the students took the post-test and the learning attitude questionnaire.

4. Results and Discussion

4.1. Learning Achievement

The learning achievement of the students in EG and CG are analyzed with ANCOVA (the analysis of covariance) by using the pre-test scores as the covariate and the post-test scores as dependent variables, as shown in Table 1. The adjusted mean value and standard error of the post-test scores were 88.33 and 1.11 for the control group, and 89.67 and 1.09 for the experimental group with F=34.05 and p<0.001. Accordingly, there was a significant difference between the two groups; that is, the students who learned with the peer tutoring-based concept map approach showed significant better learning achievements than those who learned with conventional concept map approach.

Table 1. ANCOVA results of Learning Achievement between EG and CG

Group	N	Mean	SD	Adjusted Mean	Standard error	F
EG	33	88.64	11.25	89.67	1.09	34.05[***]
CG	32	81.66	12.67	88.33	1.11	

[***]p<0.001

4.2. Learning Attitude toward the Social Science Course

The learning attitude toward the social science course of the students in EG and CG are analyzed with ANCOVA (the analysis of covariance) by using the pre-test scores as the covariate and the post-test scores as dependent variables, as shown in Table 2. The adjusted mean value and standard error of the post-test scores were 4.84 and 0.79 for the control group, and 5.15 and 0.78 for the experimental group with F=7.94 and p <0.01. Accordingly, there was a significant difference between the two groups; that is, who learned with the peer tutoring concept map approach showed significant better learning attitude toward the social science course than who learned with conventional concept map approach.

Table 2. ANCOVA results of Learning Attitude Questionnaire between EG and CG

Group	N	Mean	SD	Adjusted Mean	Standard error	F
EG	33	5.11	0.47	5.15	0.78	7.94[**]
CG	32	4.87	0.56	4.84	0.79	

[**]p<0.01

5. Conclusions and Discussions

This study aims to explore the effects of the concept map-based peer tutoring approach on students' learning achievement of and learning attitude toward the social science course. The experimental results show that the proposed approach is effective.

In the future, we plan to apply this approach to other technology-enhanced learning scenarios, such as mobile and ubiquitous learning environments, and other courses, such as natural science. In addition, more human factors, such as learning styles, self-efficacy, technology acceptance levels, will be considered.

6. Acknowledgement

7. References

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