Implementation and Evaluation of a Peer Assessment System for Enhancing Students' Animation Skills

JUNG-CHUAN YEN[1], SONGSHEN YEH[1], JIN-LUNG LIN[2]
Department of Multimedia Design[1], Office of Physical Education[2]
Takming University of Science and Technology
56, Sec.1, Huan-Shan Rd., Nei-Hu District, Taipei
TAIWAN
{lcyan, songshen, jllin}@takming.edu.tw

Abstract: - A web-based peer-assessment system for enhancing students' creativity and animation skills is presented. Through a quasi-experiment instruction, this paper was to examine the learning effects of the system with mechanisms of diverse assessment. Participants were 88 sophomores of 2D animation courses taught by the same instructor. A two-way ANOVA was conducted to analyze the independent variables by self-regulation (high vs. low) and perceived initiative (stronger vs. weaker) on project performance as the dependent variables. The results revealed that (a) there are no significantly interactions between self-regulation and perceived initiative, (b) students of the high-group of self-regulation outperformed the low-group on the peer assessment, (c) students who showed stronger initiative outperformed the weaker ones on the tutor assessment, (d) most of the learners showed positive attitude toward peer-assessment.

Key-Words: - E-learning, Animation skill, Peer-assessment, Self-regulation, Social cognitive

1 Introduction

Nowadays, the advances of Internet technologies and multimedia greatly change our lifestyles and learning behaviors. Because of innovations on educational technology, internet-based media have become an important learning platform in higher education through integrating a vast amount of knowledge into various forms [1]. Succeed to the trend of web-based instruction puts an increasingly burden on learners' motivation and capability to be responsible for their own learning processes and outcome, many researchers and educators claim applying multimedia technologies to associate rich media can effectively increase learning performance as well as conquer individual differences in several subjects [2, 3, 4]. However, some studies also indicate that students experience certain difficulties in regulating their own learning when they use hypermedia environments to learn complex topics [5]. In other words, rare efforts had been made to exploring the effects on web-based learning system with self-regulation design and suitable assessment strategies for manifesting the technologies were the strong and positive influence on learning. Therefore, it is worthy of being studied to overcome these challenges and try to construct an appropriate learning environment in a pedagogically sensible manner.

Based on the social learning theory, researchers have tried to facilitate learning by using scaffoldings designed to support learners' understanding [6]. The present study employed an e-learning system with peer-assessment mechanism to help learners become aware of their learning preference, reflect on their class assignments, and elaborate their knowledge and skill in 2D animation. The purpose of this study was to examine the effect of learners with diverse level of self-regulation (high vs. low) and perceived-initiative (stronger vs. weaker) on students' project performance by peer and tutor assessment.

2 Literature

This section explores the theoretical viewpoint and relative works to our research. First, we express the self-regulation as the most important mental process in web-based learning situation. Then, we describe the conceptions and practical procedures of peer-assessment. Finally, the students' attitudes like perceived-initiative how to affect the learning effect are discussed respectively.

2.1 Self-regulation in E-Learning

In recent years, e-learning has become the most popular and widely implementation approach for learning. The ubiquitous computing and network technologies provide various innovative learning experiences that can take place in anytime and anywhere. However, more flexibility means more

responsibility. Learners are expected more to be aware of and to control their learning by actively participating in e-learning situation. Unfortunately, most students who favor in e-learning environment not only have a poor knowledge base of effective strategies but also fail to select, evaluate, and adjust faulty strategies when they are not working effectively [7]. Thus, how to facilitate learners' active learning and provide strategies for self-control on their e-learning process has becoming a valuable issue.

Self-regulation can be defined as self-generated thoughts, feelings, and actions for attaining academic goals [5]. Researchers criticized that self-regulation refers specifically to the processes of self-awareness, self-monitoring, self-judgment and self-reactive [8]. Many researchers have verified that the procedures of self-regulation could be learned as a strategy to help students to handle their learning and to perform the learning tasks efficiently [5, 7, 8]. Therefore, one of the purposes of this study was to further explore the effects of self-regulation in e-learning environment.

2.2 Peer-Assessment as Learning Strategy

From the view of social learning theory [9], with the help of the peer assessment mechanism, learners can immerse in the cycle of peer- and self-evaluating processes, and elaborate their mental model in interchanging their feedbacks reiteratively. Peer assessment is defined as an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers with similar status [10, 11]. That is to say, peer assessment is a process of individual that rates their peers and provides feedback by pre-defined marking criteria. During this process the evaluating feedback could help learners incorporate new information into prior knowledge and promote meaningful learning. Many researches have been reported the positive results of peer assessment, such as increased learners' motivation, promoted learning self-awareness, facilitated cognitive skills development, enhanced learning outcomes, provided much scope for designing innovative learning experiences and supported constructivist educational activities by means of self-reflection [6, 9, 12, 13]. For the great progress on computer technology, internet-based investigation has made ubiquitous assessment possible in asynchronous way. Thus, digital learning environment along with diverse assessment mechanism is beginning to make a breakthrough from small-scale pilots to widely executions.

2.3 Attitudes and Perceived Initiative

Literatures have confirmed that peer-assessment is one of the most common strategies to enhance learners' collaboration and team performance [13]. However, the main value of classmates also affects the learners on how they appreciate what successful is. For example, when the classroom atmosphere trends toward competition and ranking, students have stronger or weaker social comparison will play the key factor of learning effects. On the contrary, when the classroom surrounds with cooperative feeling, the honors and progress of whole class will be the common and unique goal. The current study was an attempt to examine how students' attitudes moderates learning effects in educational settings with peer-assessment and hope to induce some suggestions by means of empirical validation.

Recently, the role of multimedia and network technology continues to expand for delivery and support of teaching activities in various learning environments. Many studies examining this trend have focused on technology issues [14, 15], student achievement [16], or collaborative design [17, 18, 19]. Previous studies, however, rarely addressed the issues of learners' attitudes that were perceived as contributing factors to the design of better digital learning activities. In literatures, various disciplines have considered the issue of learners' attitudes and perceptions of novel technologies in educational environments, such as computer proficiency, class interaction, class satisfaction, perceived-initiative, perceived-performance, willingness-to-use, ease-of-use, and helpfulness [20, 21]. Besides, Waycott and Kukulska-Hulme [22, 23] further suggested that prior experience on resemblance technologies is an influential factor to affect learners' acceptance of novel technologies. This study, therefore, aimed to examine the effects of learners' attitudes, such as perceived-initiative, toward the web-based learning with peer-assessment.

3 Methodology

3.1 Participants and Scenario

This study examined the effects of self-regulation and perceived-initiative on project performance in a 2D animation course. An e-learning system with the mechanism of peer-assessment was implemented by open source software, named Joomla. The goals of the course and the learning system were to facilitate participant's creativity and animation skills. The

participants were 88 sophomores, 37 male and 51 female, who were taking the introduction to 2D animation courses taught by the same instructor.

An 18-week course was design. It included some in-class assignments and two flash-based animation projects. The project aforementioned was employed to develop students' animation skills and cultivate their attitudes on sharing, participating, competing and collaborating. The syllabus design and content of the learning goal is shown as Table 1.

The flash-based assignments were conducted to examine learners' performance of the 2D animation skills. Students have to finish the learning tasks on schedule for assessment. The project assignments are shown as Figure 1.

3.2 Implementation of Peer-Assessment

The peer-assessments were conducted between sessions in order to promote the comprehension of animation commands and to elaborate individual cognition for knowledge construction. The system architecture was shown as Figure 2, and the project information was shown as Figure 3. In our system, the online discussion forums were employed to facilitate students to communicate with each others directly (shown as Fig. 4), and the feedbacks of peer-assessment were utilized to make a comment or criticism in a metaphor way. Thus, the procedure of discussion and peer-assessment is monitored by learners for necessary modifications toward their learning goals. However, peer-assessment doesn't mean evaluating unfounded. According to the

Table 1. The syllabus of the experiment course in present study

Session	Topics	Instructional Design
Pre-Course	Combine Student Needs	Before the class begins, students with a better skill and had taken the course are invited to form a discussion group. Based on the course plan submitted by the teacher, they are required to participate the discussion and provide their suggestions. Subsequently, each student will begin to collect and design materials for later use.
1st-3rd Week	Shape Tween	e.g. open animation, mask animation and text transformation
4th-6th Week	Moving Tween	e.g. text effect, object rotation and banner design
7th Week	Frame Animation	e.g. mouse composition and character walk cycle
9th Week	Midterm Exam	Increase the connection between midterm exam and digital subsidiary learning materials, thus, the materials are fully utilized and students are well prepared.
10th Week	Midterm Result	Midterm result is announced via digital query file to emphasize the importance of paperless concept and privacy respect.
10th-11th Week	Sound and Video	Character animation and animating dialogue using the "Mouth Comp" system
12th-13th Week	Animation Production	Animation production and implementation
14th-18th Week	Term Project Assignment	Announce term project requirement and grading policy regarding project and off campus contest participation.
15th-17th Week	Guide Line and Mask	e.g. planetary orbit, magnifier , wave, and search light simulation
18th Week	Final Exam and Peer-Assessment	A thirty-minute final exam related to guide line and mask effect is given. Peer-assessment of the term project is demonstrated on the common platform.

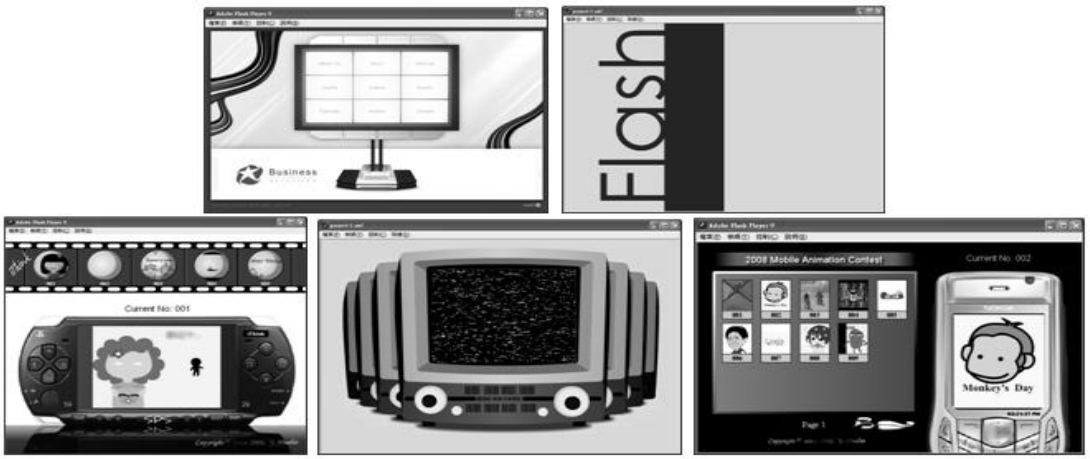

Fig. 1. The flash-based assignments of term project

criteria which were pre-formulated by the instructor (shown as Fig. 5), learners were facilitated to rank the peers' performance fairly by thinking about themselves. Therefore, peer-assessment is a suitable learning strategy for accomplishing this kind of animation project in digital learning ways.

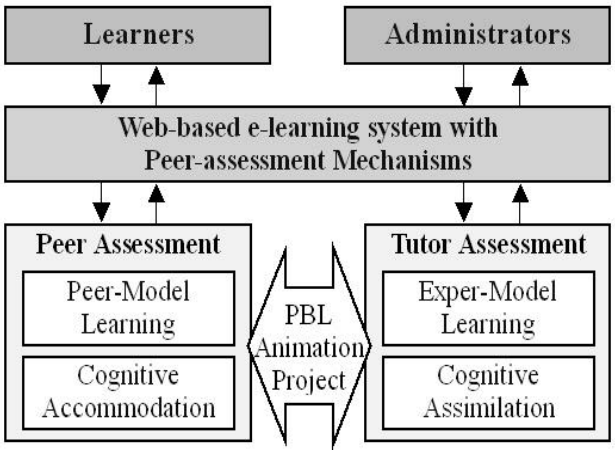

Fig. 2. The system architecture of this study

Fig. 3. The learning system of present study

Fig. 4. The discussion forums for communication

Fig. 5. The criteria of peer-assessment

3.3 Research Design and Questionnaire

A 2x2 factorial research design was employed with two levels of self-regulated strategies (high vs. low) and two levels of perceived initiative (stronger vs. weaker). The dependent variables were the peer-assessment and tutor-assessment on term project. A 2-way ANOVA was conducted to analyze the main effects of the two independent variables on the dependent measures, respectively. As for the high-low group procedure was employed to identify the top fifty percent participants as the high-group and the others as the low-group according to the investigative results of research instruments. The significance level (Alpha) was set to .05 for the data analysis.

There were three research instruments utilized in this study, including a revision of subscale of MSLQ (motivated strategies for learning questionnaire [24]), a revision of college student perceived initiative scale [25], and an attitude questionnaire developed by the researchers. These instruments are described as follows.

The MSLQ, based on a general cognitive view of motivation and learning strategies, consisted of three aspects of subscales, including the motivation, the learning strategies and the metacognitive strategies subscale. The motivation section consists of 31 items that assess students' goals and value beliefs for a course. The learning strategies section includes 31 items regarding students' use of different cognitive and metacognitive strategies and 19 items concerning student management of different learning resources. In this study, we chose 6 items from the subscale of metacognitive as the

examination of learners' approach of self-regulated strategies. The original reliability was .943 (Cronbach's alpha), in present study, the reliability of the revision of self-regulated subscale was .872 (Cronbach's alpha).

The perceived initiative scale surveyed learners' stronger or weaker mentality as reflection on their own learning. The scale was developed by Lin and Huang [24] and is suitable for use on the vocational college students especially. This scale consisted of 6 items and described by the 5-point Likert-type. The original reliability was .859 (Cronbach's alpha). In our study, the reliability of the perceived initiative scale was .863 (Cronbach's alpha).

An online attitude questionnaire was conducted to examine learners' perception of enhancement, motivation, and impartiality toward the peer assessment. Learners were asked to rate themselves on a 5-point Likert-type scale with response options ranged from 1 (strongly disagree) to 5 (strongly agree). The reliability coefficient of attitude questionnaire was .813 (Cronbach's alpha).

A summary of the reliability of our research instruments are shown as Table 2.

Table 2. A summary of reliability of present study

Research Instruments	Items	Cronbach's α
Self-regulated Strategy (subscale of MSLQ)	6	.872
Perceived Initiative	6	.863
Attitude on web-based Peer- Assessment	6	.813

4 Result and Discussion

The purpose of this study was to examine the learning effects of an animation e-learning system with mechanisms of diverse assessment. Originally, the mean scores of self-regulation and perceived initiative are shown in Table 3. According to the analysis, the high-group students of self-regulation scored higher than the low-group both in the peer-assessment and tutor-assessment. Similarly, the stronger-group of perceived initiative scored higher than the weaker-group both in the peer and tutor assessment.

A self-regulation × perceived initiative standard ANOVA was employed to examine the effects of participants' performance on peer assessment (scored by classmates) and final scores (scored by instructor). Prior to these ANOVA, Levene's test for equality of variances is performed, and both of the test were not significant (peer-assessment: F=1.508, p=.218; tutor-assessment: F=.222, p=.881). Thus, the variances in the manipulation groups are not different and therefore the assumptions for ANOVA are met.

Table 3. Mean scores of self-regulation and perceived initiative on the performance

Self-Regulation	Perceived Initiative	Peer-Assessment		N
		M	SD	
High	Stronger	69.45	7.12	22
	Weaker	66.27	8.21	22
	Total	67.86	7.76	44
Low	Stronger	67.05	11.85	22
	Weaker	64.82	13.61	22
	Total	65.93	12.66	44
Total	Stronger	68.25	9.74	44
	Weaker	65.55	11.13	44
	Total	66.90	10.49	88
Self-Regulation	Perceived Initiative	Tutor-Assessment		N
		M	SD	
High	Stronger	85.09	7.62	22
	Weaker	82.86	7.27	22
	Total	83.98	7.44	44
Low	Stronger	84.32	7.71	22
	Weaker	80.36	8.34	22
	Total	82.59	8.25	44
Total	Stronger	84.95	7.58	44
	Weaker	81.61	7.83	44
	Total	83.28	7.84	88

Meanwhile, Pearson product-moment correlation was conducted to evaluate the consistency between the peer-assessment and tutor-assessment. The correlation coefficients for the peer-assessment and tutor-assessment were very significant (r =.608, p<.01). The results expressed that the reliability between peer-assessment and tutor-assessment was consist and acceptable.

4.1 Two-way Interaction Was Insignificant

In peer-assessment, the 2-way interaction of 2 × 2 between-subjects design on peer-evaluation was not significant (F(1, 84)=.045, p=.832). The detail of statistic analysis was shown as Table 4.

Table 4. 2-way ANOVA summary of self-regulation and perceived initiative on peer-assessment

Dependent Variable: Score of peer-assessment

Source	df	M Square	F	p
Self-regulation (SR)	1	37.102	4.740	.036
Perceived initiative (PI)	1	160.920	1.451	.232
SR × PI	1	5.011	.045	.832
Error	84	110.905		

R Squared = .026 (Adjusted R Squared = -.009)

Further check the main effect of perceived initiative showed that there was not significant (F(1, 84)=1.451, p=.232). However, the main effect of

self-regulation was significant ($F(1, 84)=4.740$, $p=.036$). The results revealed that diverse levels of perceived initiative seem hardly to affect the peer-assessment on participants' performance in this study, but the self-regulation probably did. So, an additional discussion on the self-regulation would be described in segment 4.2.

Furthermore, in tutor-assessment, the interaction of between-subjects effects on instructor assessment was also not significant ($F(1, 84)=.455$, $p=.502$). Further check the main effect of self-regulation ($F(1, 84)=.705$, $p=.403$) was not significant. However, the main effect of perceived initiative revealed that there was significant ($F(1, 84)=4.097$, $p=.046$, shown as Table 5). Thus, a further investigation on the perceived initiative would be also described in segment 4.3.

Table 5. 2-way ANOVA summary of self-regulation and perceived initiative on tutor-assessment

Dependent Variable: Score of tutor-assessment

Source	df	M Square	*F*	*p*
Self-regulation (SR)	1	42.284	.705	.403
Perceived initiative (PI)	1	245.557	4.097	.046*
SR × PI	1	27.284	.455	.502
Error	84	59.938		

R Squared = .059 (Adjusted R Squared = .025)

4.2 High-group of Self-regulation Performed Better than the Low-group in Peer-Assessment

As can be seen from Table 4, the main effect of self-regulation was significant. Further check the main effect analysis of self-regulation found that the high-group (M=84.96, SD=1.17) scored higher than the low-group (M=81.61, SD=1.17). It was shown as Table 6.

Table 6. Main effect analysis of self-regulation

Self-Regulation	M	SD	95% Confidence Interval	
			Lower Bound	Upper Bound
High	84.27	1.31	82.96	87.64
Low	81.93	1.16	80.03	83.58

The data indicated that the learners with high self-regulation performed better than the lower ones significantly while the project achievement was evaluated by classmates in web-based learning system. The result of self-regulation on learning performance was similar to the researches of Zimmerman [8] and Miller and Brickman [26] that learners who have superior ability of self-regulation got higher scores in technology-based course. The implication of this study is that providing self-regulation scaffolding seems able to enhancing students' performance in web-based learning system with peer-assessment mechanism.

4.3 Stronger-group of Perceived Initiative Performed Better than the Weaker-group in Tutor-Assessment

As can be seen from Table 5, the main effect of perceived initiative was significant. Further check the main effect analysis of perceived initiative found that the stronger group (M=84.96, SD=1.17) scored higher than the weaker group (M=81.61, SD=1.17), It was shown as Table 7.

Table 7. Main effect analysis of perceived initiative

Perceived Initiative	M	SD	95% Confidence Interval	
			Lower Bound	Upper Bound
Stronger	84.96	1.17	82.63	87.28
Weaker	81.61	1.17	79.29	83.94

The data indicated that the learners with stronger perceived initiative scored better than the weaker ones significantly while the project achievement was evaluated by instructors in web-based learning system. The result of perceived initiative on learning performance was similar to the research of Chen and Yen that learners who showed stronger perceived initiative got higher scores in web-based learning environment [21]. However, which was opposite to the Shen, Lee and Tsai that students no matter with stronger or weaker perceived initiative almost got the same performance toward learning activity [27]. As for the attitude aspect, there is an interesting phenomenon and seems worthy to pay more attention on why perceived initiative could result in this outcome.

4.4 Most Learners Show Positive Attitude on Helpfulness toward Peer-assessment

In present study, the online peer assessment was employed to furnish the observational learning opportunity by rating their classmates and providing feedbacks in accordance with pre-defined criteria. This process could facilitate learners incorporate new information into prior knowledge and promote meaningful learning.

Multivariate analyses of variance (MANOVA) were performed to explore the participants' attitude on the design of the web-based learning system. The original mean scores and standard deviation are shown in Table 7. In general, participants almost showed positive attitudes toward the enhancement, motivation, and impartiality of peer-assessment.

Table 7. The original mean scores and standard deviation of participant's attitudes

Items of Questionnaire	M	SD
Perception toward Enhancement		
1. Peer modeling and sharing can assist my creativity stimulation and development.	4.13	.640
2. The atmosphere on the web site in peer modeling and sharing can stimulate my creativity.	4.07	.603
Perception toward Motivation		
3. Peer assessment in term project can increase my learning interests.	4.02	.742
4. Peer assessment in term project makes me throw myself into project creation actively.	3.91	.560
Perception toward Impartial		
5. Mechanism of the peer assessment is fair and reasonable.	3.82	.653
6. My efforts on project creation can obtain others positive attitude.	3.76	.678
Total	3.951	.421

The MANOVA summary of self-regulation and perceived initiative on attitude is shown in Table 8. The difference of participants' attitudes between groups would be further examined and described respectively.

Table 8. The mean scores of the attitudes on self-regulation and perceived initiative groups

Independent Variables	Aspects	M	SD	N
Perception toward Enhancement				
Self-regulation	High	4.21	0.57	44
	Low	3.94	0.46	44
Perceived Initiative	Stronger	4.23	0.55	44
	Weaker	4.03	0.51	44
Total		4.12	0.54	88
Perception toward Motivation				
Self-regulation	High	4.21	0.54	44
	Low	3.78	0.46	44
Perceived Initiative	Stronger	4.06	0.49	44
	Weaker	3.97	0.57	44
Total		4.05	0.56	88
Perception toward Impartial				
Self-regulation	High	3.93	0.53	44
	Low	3.65	0.59	44
Perceived Initiative	Stronger	3.91	0.47	44
	Weaker	3.43	0.66	44
Total		3.82	0.58	88

All of the 2-way interactions were not significant (Enhancement: $F(1, 84)=.257$, $p=.613$; Motivation: $F(1, 84)=.393$, $p=.533$; Impartial: $F(1, 84)=.755$, $p=.387$). Nevertheless, the main effects of self-regulation on perception of motivation ($F(1, 84)=11.165$, $p=.001$) was significant and indicated that learners with high self-regulation (M=4.21) perceived higher level of motivation effect of peer-assessment than those who with low (M =3.94). Similarly, the main effects of self-regulation on perception of impartiality ($F(1, 84)=5.826$, $p=.018$) was significant and indicated that learners with high self-regulation (M=3.93) felt more impartial on the process of peer-assessment than those who with low (M=3.65).

Table 9. MANOVA summary of self-regulation and perceived initiative on attitude aspects

Source / Aspect	SS	df	MS	F	Sig.
Self-regulation × Perceived Initiative					
Enhancement	.071	1	.071	.257	.613
Motivation	.102	1	.102	.393	.533
Impartial	.230	1	.230	.755	.387
Self-regulation					
Enhancement	1.026	1	1.026	3.714	.057
Motivation	2.909	1	2.909	11.165	.001*
Impartial	1.776	1	1.776	5.826	.018*
Perceived Initiative					
Enhancement	.139	1	.139	.504	.480
Motivation	.068	1	.068	.244	.836
Impartial	1.253	1	1.253	4.111	.046*
Error					
Enhancement	23.193	84	.276		
Motivation	21.886	84	.261		
Impartial	25.602	84	.305		

Furthermore, the main effects of perceived initiative on perception of impartiality ($F(1, 84)= 4.111$, $p=.046$) was significant and indicated that learners with stronger perceived initiative (M=3.91) felt more fair on the process of peer-assessment than those who with weaker (M =3.43).

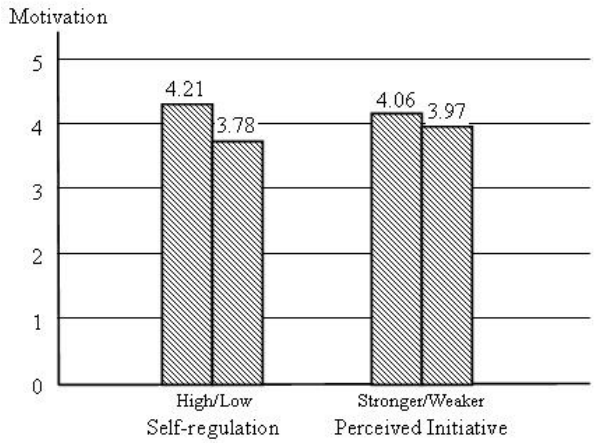

Fig. 6. Learners' perceptions toward motivation

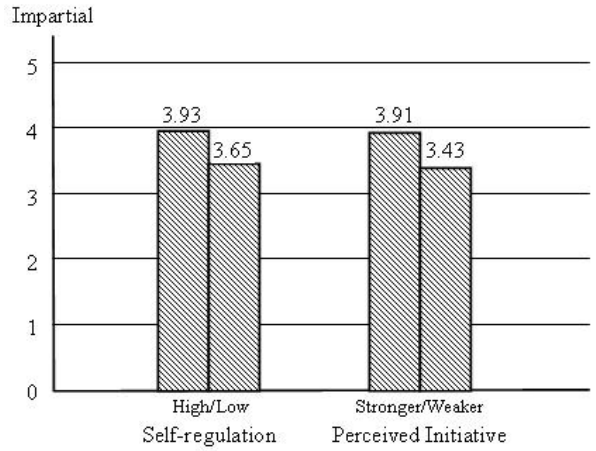

Fig. 7. Learners' perceptions toward impartial

Summarily, no matter what the participants with high or low self-regulation and stronger or weaker perceived initiative, they all held the similar positive attitudes (nearly all the Mean greater than 3.5) toward enhancement, motivation, and impartiality. In addition, learners with diverse level of self-regulation and perceived initiative both perceived the motivation and impartiality aspect positively, but learners with high self-regulation and stronger perceived initiative possessed higher degree attitude than the others.

5 Conclusion

The findings of present study can be summarized as shown in Table 10. For the performance on peer assessment, the similarity of self-regulation and perceived initiative were found. Although the stronger group of perceived initiative outperformed than the weaker group in term project was opposite to some theoretical reasoning [27], researcher also addressed that cross-cultural seems to be the potential factor of psychological experiment [29, 30]. By contrast with learners' attitude toward impartiality, there is interesting phenomenon that learners with weaker perceived initiative actually revealed lower degree perception on the impartiality of peer-assessment. As for the attitude aspect, most of the participants got the positive perception toward learning activity.

Table 10. Summary of the effects in present study

Aspects	Self-regulation	Perceived Initiative
Performance		
Interactions	No significant	
Peer-assessment	Higher > Lower	No significant
Tutor-assessment	No significant	Stronger > Weaker
Attitudes		
Enhancement	No significant	No significant
Motivation	Higher > Lower	No significant
Impartial	Higher > Lower	Stronger > Weaker

In this research, we found that when learner has high self-regulation and strong perceived initiative then his performance will be enhanced and his attitude will be positively facilitated. The employed social learning approach revealed that our concerns seem to be helpful for instructional design to provide self-regulation strategies and create enthusiastic classroom atmosphere to serve as scaffolding for learning. In addition, the experimental results of peer-assessment also demonstrated several specific issues for further studies and some implications for educational practice. The present study concludes that (a) there are no significantly interactions between self-regulation and social comparison in e-learning system with peer-assessment, (b) students of the high-group of self-regulation outperformed the low-group on the peer assessment, (c) students who showed stronger initiative outperformed the weaker ones on the tutor assessment, and (d) most of the learners positive attitude toward enhancement and motivation of peer-assessment, nevertheless in impartiality, the high self-regulation and stronger perceived initiative learners possessed higher degree attitude than the others.

Acknowledgement

This study was sponsored by the National Science Council of Taiwan, project number: NSC 97-2511-S-147-001.

References:

[1] J. G. Jones, C. Morales, and G. A. Knezek . 3-Dimensional online learning environments: Examining attitudes toward information technology between students in Internet-based 2-dimensional and face-to-face classroom instruction. *Educational Media International*, Vol. 42, No. 3, 2005, pp. 219-236.

[2] R. E. Mayer, Introduction to multimedia learning. In Richard E. Mayer (Ed.). *The Cambridge handbook of multimedia learning*, Cambridge, NY: Cambridge University, 2005.

[3] R. C. Clark, and R. E. Mayer, *E-learning and the science of instruction*. San Francisco: Pfeiffer, 2003.

[4] R. E. Mayer, and R. Moreno, Animation as an aid to multimedia learning, *Educational Psychology Review*, Vol. 14, No. 1, 2002, pp. 87-99.

[5] R. Azevedo, J. G. Cromley, and D. Seibert, Does adaptive scaffolding facilitate students ability to regulate their learning with hypermedia? *Contemporary Educational Psychology*, Vol. 29, 2004, pp. 344-370.

[6] E. Z. F. Liu, S. S. J. Lin, and S. M. Yuan, Alternatives to instructor assessment: A case study of comparing self and peer assessment with instructor assessment under networked innovative assessment procedure. *International Journal of Instructional Media*, Vol. 29, No. 4, 2002, pp. 1-10.

[7] G. Y. Kao, S. S. J. Lin, and C. T. Sun, Beyond sharing: Engaging students in cooperative and competitive active learning. *Educational Technology and Society*, Vol. 11, No. 3, 2008, ppt. 82-96.

[8] B. J. Zimmerman, Developing self- fulfilling cycles of academic regulation: An analysis of exemplary instructional model. In D.H. Schunk and B.J. Zimmerman (Eds.), *Self-regulated learning: From teaching to self-reflective practice* (pp.1-19). New York: Guilford, 1998.

[9] A. Bandura, *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall, 1986.

[10] K. J. Topping, Peer assessment between students in colleges and universities. *Review of Educational Research*, Vol. 68, No. 3, 1998, pp. 249-276.

[11] K. J. Topping, Trends in peer learning. *Educational Psychology*, Vol. 25, No. 6, 2005, pp. 631-645.

[12] C. T. Sun, Learning by Judging: A Network Learning Environment Based on Peer Evaluation. *International Journal of Continuing Engineering Education and Lifelong Learning*, Vol. 12, No. 1-4, 2002, 149-158.

[13] D. H. Schunk, Peer modeling. In K. J. Topping, and S. W. Ehly, (Eds.), *Peer-assisted learning* (pp.185-202). Mahwah, NJ: Lawrence Erlbaum Associates, 1998.

[14] C. Y. Chang, J. P. Sheu, and T. W. Chan, Concept and design of Ad Hoc and mobile classrooms. *Journal of Computer Assisted Learning*, Vol. 19, No. 3, 2003, pp. 336-346.

[15] K. K. Tan, and H. L. Goh, Development of a mobile spreadsheet-based PID control simulation system. *IEEE Transactions on Education*, Vol. 49, No. 2, 2006, pp. 199-207.

[16] K. E. Chang, Y. T. Sung, and S. F. Lin, Computer-assisted learning for mathematical problem solving. *Computer and Education*, Vol. 46, 2006, pp. 140-151.

[17] J. Roschelle, and R. Pea, A walk on the WILD side: How wireless handhelds may change computer-supported collaborative learning. International *Journal of Cognition and Technology*, Vol. 1, No. 1, 2002, pp.145-118.

[18] H. Cole, and D. Stanton, Designing mobile technologies to support co-present collaboration. *Personal and Ubiquitous Computing*, Vol. 7, No. 6, 2003, pp. 365-371.

[19] B. Patten, I. A. Sanchez, and B. Tangney, Designing collaborative, constructionist and contextual applications for handheld devices. *Computers and Education*, Vol. 46, No.3, 2006, pp. 294-308.

[20] D. Jong, T. S. Wang, and B. F. Lee, Student attributes in PDA-utilized classes. *Proceedings of the 5th IEEE International Conference on Advanced Learning Technologies* (ICALT 2005), 722-724. Kaohsiung, Taiwan, July 5-8.

[21] M. P. Chen, and J. C. Yen, Learners' perception of mobile learning: An individual difference perspective, *WSEAS Transactions on Advances in Engineering Education*, Vol. 4, No. 6, 2007, pp. 131-136.

[22] J. Waycott, and A. Kukulska-Hulme, Students' experiences with PDAs for reading course materials. *Personal and ubiquitous computing*, Vol. 7, No. 1, 2003, pp.30-43.

[23] H. M. EL-Bakry, and N. Mastorakis, Realization of E-University for Distance

Learning, *WSEAS Transactions on Computer*, Vol.1, No.1, 2008, pp.48-62.

[24] P. R. Pintrich, and E. De Groot, Motivational and self-regulated learning components of classroom academic performance, *Journal of Educational Psychology*, Vol. 82, 1990, pp. 33-40.

[25] M. C. Lin, and P. C. Huang, Research of the forming-reasons and learning difficulties in low-achieving college students, using Takming Junior College as an example. *Journal of Takming College*, Vol. 16, 2000, pp. 373-396.

[26] R. B. Miller, and S. J. Brickman, A model of future-oriented motivation and self-regulation. *Educational Psychology Review*, Vol. 16, No. 1, 2004, pp. 9-33.

[27] P. D. Shen, T. H. Lee and C. W. Tsai, Facilitating Students to Pass Certificate Tests via Blended E-Learning with Self-Regulated Learning: A Quasi-experimental Approach. *WSEAS Proceedings on Multimedia, Internet & Video Technologies*, 2007, Beijing, China.

[28] L. Festinger, A theory of social comparison processes. *Human Relations*, Vol. 7, 1954, pp. 117-140.

[29] H. W. Marsh, and K. T. Hau, Big-fish-little-pond effect on academic self-concept: A cross-cultural (26-country) test of the negative effects of academically selective schools. *American Psychologist*, Vol. 58, 2003, pp. 364-376.

[30] J. C. Yen, and M. P. Chen, Patterns of Reflection for Problem-Solving in a Mobile Learning Environment. *International Journal of Education and Information Technologies*, Vol. 2, No. 1, 2008, pp. 13-17.