

Full Length Research Paper

A development of a collaborative blended learning model to enhance learning achievement and thinking ability of undergraduate students at the Institute of Physical Education

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Received 16 June, 2015; Accepted 30 July, 2015

This research aimed to develop a model of a collaborative blended learning-CoBl- to develop learning achievement and thinking ability of undergraduate students in the Institute of Physical Education. The research is divided into three phases using the blended learning model via collaborative learning with thinking abilities approach as follows: Phase 1 consists of the development of the collaborative blended learning model; phase 2 the effects of implementing from the model to develop thinking abilities; phase 3, the presentation of the developed model to a group of experts for accepting the developed model. The findings showed that: there are four components in the model of collaborative blended learning namely principles, objectives, procedures and instructional activities, and measurement and evaluation. The instructional processes are divided into 3 phases, namely, preparation, learning management, and measurement and evaluation. The experimental group of students showed gains in learning achievement and thinking abilities as a whole and in each subscale from before learning with the developed model at the .05 level of significance. They showed greater learning achievement than the control group of students ($p = .001$). However, the two groups of these students did not statistically indicate different thinking abilities ($p = .501$). In addition, the students showed their opinions about learning with the developed model at the high agreed level. Also, the experts assessed the developed model at the most appropriate level.

Key words: Blended learning collaborative learning model, think ability.

INTRODUCTION

Due to the rapid changes in modern society and technology, the educational systems, particularly the

higher education have to be developed in order to provide learners good learning atmosphere, proper

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learning materials and other facilities to ascertain that learners can learn from those learning materials and other learning resources anytime and anywhere. This is to develop learners individually based on his or her own learning potential as prescribed in a section of national educational act as learner should possess learning, mastering, and learning process. According to the National Education Act of B.E. 2542 (1999) the revised edition of B.E. 2545 (2002), Ministry of Education (2003), learners should be promoted on thinking ability such as analyzing and synthesizing. Learners can learn from real experiences in order to be able to practice, think, and perform. This will prepare learners to confront and solve problems in their real lives.

Physical education, sport and health sciences are one of the educational systems which develop and adjust rapidly for this field of study to help learners to be physically fit. In addition, this field of study also emphasizes utilizing experiences, problem solving, and well understanding of real life. Moreover, Physical Education has to emphasize the development of learners' cognition, in order for them to think, perform, analyze, and create new things as prescribed in the physical education curriculum of the Institute of Physical Education in 2013. Its goals are to help learners gain specific skills and techniques which they can apply to their chosen careers. The graduates gain creative thinking, love learning, skills, and critical thinking to solve problems (Institute of Physical Education, 2007). This relates to Thai Qualification Framework for Higher Education; TQF; HED 2006 which states five developments of Thai learners of higher education. They are the development of moral and ethics, cognition, intellectual skills, interpersonal relationship and responsibility, critical thinking and communication skills. Obviously, thinking ability is necessary for students in higher education as one of the desirable characteristics and important learning goals especially for the current society which is always changing rapidly. It is therefore, necessary to possess thinking ability (Guilford and Hoepfner, 1971).

Collaborative learning and the development of thinking ability

Collaborative learning is an important pedagogy that is particularly meaningful for students, who are often adults returning to college. (Jones, 2014). Collaborative learning is an approach of learner -centered. It emphasizes the construction of a learning environment which introduces learners to learn through the performance of learning activities. It is humans' philosophy to collect and assign duty to all members and pay respects to others in order to understand learning from cognitive and social perspectives (Barkley et al., 2014). According to this approach,

students have to interact with their peers, to get responsibility to their own, to utilize small group skills appropriately, to discuss with peers, and to help and share with the other group members. They have the same goal as to be successful and increase score of learning achievement (Johnson and Johnson, 1994). Collaborative learning also introduces good atmosphere for learning. This helps learners discover ways to construct knowledge themselves, incubate positive attitude toward learning, and gain more score of learning achievement (Arend, 1997). Collaborative learning is active learning which contributes many outcomes that are beneficial to learners and all other group members in participating and getting responsibility for their own learning (Johnson et al., 2014). Collaborative learning can be applied to computer online instruction in order to increase effectiveness and quality of learning activities which emphasize the development of learning environment. Through the developed learning environment, learners learn together in a small group. They can learn anytime and anywhere with anyone. This learning environment gives more learning opportunities to learners to interact with teacher and peers without considering if they are at the same place or time. Cognitive interactions between learners and teacher, learners and peers are introduced because computer network has appropriate qualification to collaborative learning. According to the communication on computer network, the problems on time and places are solved. Moreover, computer network can link together many learning resources which promote knowledge enquiry of specific and related problems (Mc Alpine and Clements, 2001).

Blended learning; a combination of strength between classroom and online learning

Problems of traditional classroom learning as teacher centered approach are that there was only one learning material. Learner can communicate through only one way of communication. Learners always receive knowledge as passive learning. They cannot review once learned information as they want. This does not make learners to think, perform, and solve the problems. However, there are limitations to computer online learning as learners have to search from many links. Connecting to many links pushes learners to access online material which is more difficult to read than the printed materials. This may harm learners' interests. Some learners may not stay away from keeping contact with teachers and their peers. Without good learning activities preparation of teachers, learners may not succeed in learning (Khan, 1998). Moreover, blended learning requires advance computer skills and learning maturation as self-directed learning among learners. To fill in above mentioned gaps, the

combination of computer online and tradition classroom is introduced. The contributions of computer online learning are synchronous live e-learning and asynchronous self-paced e-learning while the contributions of traditional classroom are face to face learning and collaborative learning. The strong points of both are combined to be elective for all educational levels especially for higher education as the study of Sigh and Reed, which focused on the benefits of internet as a learning material to develop learning environment to support learning activities based on the combination of online and tradition classroom learning through collaborative learning in order to help learners learn effectively.

In conclusion, this study focused on formulating a blended learning model based on collaborative learning approach in order to develop thinking ability among the Institute of Physical Education students in Thailand. The research aims to answer three questions: Firstly, what are the key elements and instructional process of CoBl model? Secondly, to what extent does the model influence students' learning achievement and thinking ability? Thirdly to what extent is the instructional model approved by experts? The purposes of the study are to develop an instructional model based on blended learning and collaborative learning, to study the results of implementing the CoBl model to enhance students' learning achievement and thinking ability, and to present and approve the effectiveness of CoBl Model.

METHODOLOGY

This study is the research and development work which aimed to formulate the model for Collaborative Blended learning instruction. There are three main phases of the methodology as follows:

Phase 1: developing an efficient, collaborative blended learning model to enhance learning achievement and thinking abilities

Step 1: Studying of Collaborative learning and Blended learning Model Instruction. There are two steps as follows: Studying of characteristics and elements of Collaborative learning and Blended learning Model. This initial phase involves teaching model, Blended learning, Collaborative learning theory, thinking ability, principles of instructional design, and contemporary conditions and needs of online instruction. These are necessary in formulating an appropriate model based on related theories and concepts. The researchers brought the literature reviews for analysis and synthesis to define the research framework and other necessary components.

Step 2: Survey of conditions, usage, and needs in traditional classroom and online instruction. The areas of questions covered the application of face to face learning and online instruction. The possible research framework was administered on three sample groups: 1) instructors (n=201) and students (n=304) to do the questionnaires on usage and needs for face to face learning and online instruction. The sample was selected by using stratified random sampling method from a total population of 412 in 17

Institutes of physical education in the academic year 2012. Sample size was determined by Krejcie and Morgan's table at 95% significant level (Krejcie and Morgan, 1970). Similarly, the sample of the students was selected by the same criteria from a total population of 5,848 who were studying in 17 Institutes of physical education in the academic year 2012; 2) higher education instructors (n=15), and students (n=15) were interviewed ; the sample of the instructors and students was selected by using simple random sampling method from three universities; and 3) experts (n=9) to assess the developed model; the experts had experience in instructional design, educational technology and communication.

The questionnaire was based on research framework and administered separately between instructors and students. Prior to administration, the questionnaires were validated by the major advisor and experts who had experience in conducting research in graduate level. It was found that each questionnaire for usage and needs yielded the Cronbach's alpha coefficient value of 0.976 and 0.964 respectively.

Step 3: Drafting a model was based on ADDIE Model employing the findings of review literature and output of the survey and interview of the instructors and students.

Step 4: Examining the appropriateness of the model by nine experts in instructional design. As can be seen in Figure 1, the experts suggested that this model should include collaborative learning activities as a component because this principle can develop thinking ability of the learners.

Step 5: Constructing tools to accompany the model: face to face learning and online lessons on the Learning Management System – LMS, achievement tests, thinking ability test, and questionnaires. Achievement test was 4-multiple-choice test; the correct answer value was 1 point while incorrect was 0. Total questions in this test were 60. Difficulty Index was between 0.29-0.74, Discrimination Index B was between 0.20-0.81 (Brennan, 1972), and Reliability Index was 0.91 (Lovett, 1978).

Thinking ability test was 3-multiple-choice test: the correct answer value was 1 point while incorrect was 0. Total questions in this test were 60. Difficulty Index was between 0.34-0.77, Discrimination Index B was between 0.31-0.88, and Reliability Index was 0.95.

Questionnaire aimed to survey the opinions of the students who participated in stage 1) Pre-instruction, 2) Instruction, and 3) thinking ability development in the CoBl instruction. It was 5-level Likert's scale, the questionnaires were validated by the major advisor and experts who had experience in conducting research in graduate level. Total questionnaire in this survey was 33 and yielded the Cronbach's alpha coefficient value of 0.96.

The online lesson was constructed on the Moodle LMS platform. Draft of the lesson included flowchart and storyboard of the collaborative blended learning and thinking ability development scenarios. It was tested by the major advisor and experts for content and quality prior to implementation.

Phase 2: Study of the results of implementing the CoBl model

This finds the effectiveness and efficiency of the model as well as conditions and processes that enhance the learners' learning achievement and thinking ability. The quantitative method was used by a comparison of scores on learning achievement and thinking ability. Meanwhile qualitative method was used to describe opinion of learners on CoBl model.

The sample group was 60 undergraduates who enrolled for the

Table 1. Two-group time-series research design.

Group	Time			
			X	
Experiment	E (R)	T1, Y1	X	T2, Y2
Control	C (R)	T1, Y1		T2, Y2

X = CoBI Model; Y1 = 1st round of Thinking ability Test; Y2 = 2nd round of Thinking ability Test; T1 = Pre-test of Achievement Test; T2 = Post-test of Achievement Test; R = randomization.

course of Information for Study skill for 14 weeks, 3 hours each, in the first semester of academic year 2013; they major in Physical Education, Institute of Physical Education Mahasarakham Campus. They were assigned to two groups; experimental and control group (thirty each). The experimental group learned the developed model and the control group learned the traditional instruction.

The sample of the undergraduates was selected by simple random sampling method and matching for variance control from total population of 326 in the Institute of Physical Education Mahasarakham campus. All the students took the course for the first time.

The research tools of the model in phase 2 of CoBI find out the learning achievement, thinking ability, and opinion.

The tools were CoBI instructional model that encouraged learning achievement and thinking ability among physical education undergraduates, an achievement test which reflects content knowledge on the course objectives, a thinking ability test which covered skills on: organizing, applying, analyzing, knowledge generating, integrating, and evaluating, and questionnaire which indicated opinions and experiences from using LMS.

Implementation of the experiment began by introducing the learners to CoBI model using face to face instruction and online learning employing various tools such as chat room, web board, and e-mail. The course lasts 14 weeks of the course while the first week was pre-test and the fourteenth week was post-test on achievement tests, thinking ability test, and questionnaires.

The collected data were analyzed using percentage, mean, standard deviation. To test the hypotheses, the dependent t-test and the F-test (One-way MACOVA and ANCOVA) were employed. Research design was the Two-group Time-series shown in Table 1.

RESULTS

The intended instructional model was the combination of an instructional system using the best features of the traditional and online instruction. According to blended learning, a learner can learn without the limits of time and place with an emphasis on live e-learning (synchronous) and self-paced e-learning (asynchronous) interaction, relevant to the learner-centered activities. The proportion of online learning and face to face learning is approximately 50 percent. The instructional model was constructed, implemented, presented and assessed. The results were as follows.

Research question 1: What are the key elements and instructional procedures of CoBI model?

Key elements and instructional procedures of CoBI model are; 1) basic principles, concepts, or theories of the model, 2) objectives of CoBI model, 3) teaching methods and activities, and 4) model's measurement and evaluation. Instructional activities in the instructional scheme involve the integrated steps between collaborative and thinking ability learning activities towards three steps of instructional procedures: five steps of pre-instruction activities were 1) Orientation, 2) Registration and Training 3) Group Setting, 4) Learning Ability Pretest, 5) thinking ability Pretest. Nine steps of instructional activities were 1) Stated objectives, 2) Study content, 3) Present situation, 4) Plan Determine choice, 5) Explorer / Search, 6) Analyze, 7) Conclusion Presentation, 8) Evaluation and extended learning, and 9) Unit Test. Finally, thinking ability and learning achievement evaluation were assigned at the end of the last lesson as shown in Figure 1.

Research question 2: To what extent does the model influence students' learning achievement and thinking ability?

The findings on the influence of the CoBI model on learning achievement can be concluded as follows. According to the experiment group, the score from posttest was 48.03 (SD = 3.92) at 80.05%; the control group pretest score was 26.30 (SD = 4.28) at 43.83%; the score from posttest was 44.40 (SD = 4.31) at 74.00% (Table 2). The development of learning achievement is demonstrated in Figure 2.

The findings on the influence of the CoBI model on thinking ability can be concluded as follows. According to the experiment group, the score from posttest was 31.60 (SD = 5.44) at 52.68%; the control group pretest score was 27.13 (SD = 6.08) at 45.21%; the score from posttest was 30.47 (SD = 4.71) at 50.78% (Table 3).

The development of thinking ability is demonstrated in Figure 3. The experimental group of students showed gains in learning achievement and thinking abilities. However the two groups of these students did not indicate different thinking abilities as seen in Tables 4 and 5. According to questionnaire on CoBI implementation, the students gave high degree for overall opinion ($\bar{x} = 4.23$, S.D. = 0.65). The high degree of the opinion showed in the aspect of 'they get better in searching and collecting Information' ($\bar{x} = 4.50$, S.D. = 0.63) and that of 'they can practice more on their assignment' ($\bar{x} = 4.50$, S.D. = 0.63); followed by "they are more confident in learning" ($\bar{x} = 4.43$, S.D. = 0.57).

Research question 3: To what extent is the instructional model approved by experts?

The experts agreed that a CoBI model was appropriate in

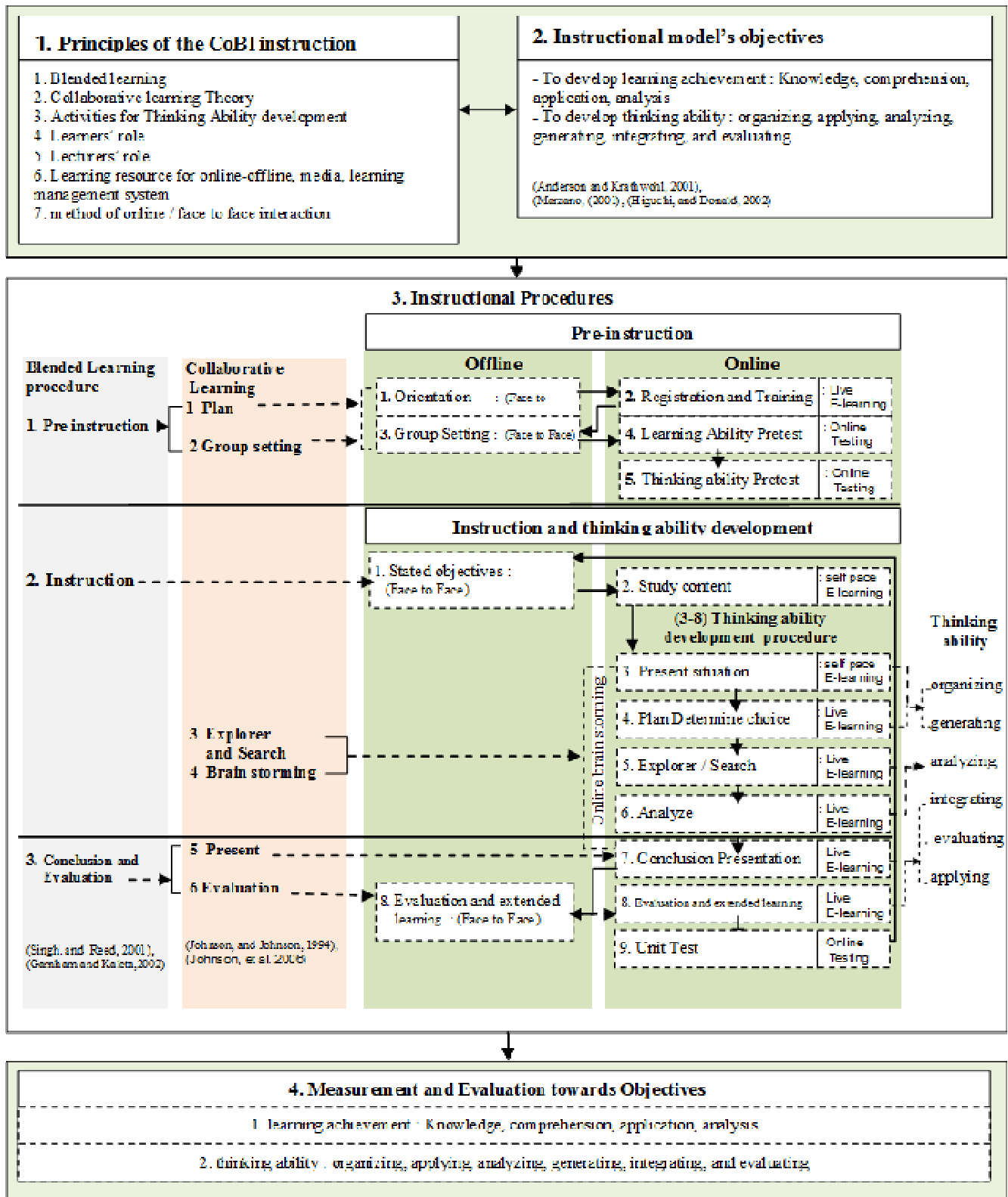


Figure 1. A model of a collaborative blended learning model to enhance learning achievement and thinking ability of undergraduate students at the Institute of Physical Education.

Table 2. Result of comparison learning achievement between pre-test and post-test experimental and control groups.

Group	n	Pre-test		Post-test		t	P
		\bar{X}	S.D.	\bar{X}	S.D.		
Experiment	30	29.67	3.77	48.03	3.92	-17.93**	.000**
Control	30	26.30	4.28	44.40	4.31	-15.23**	.000**

** Statistical significance level at .05.

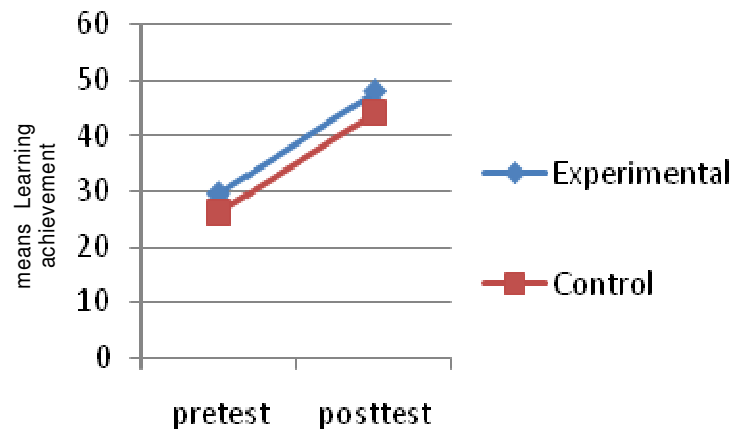


Figure 2. The means score of learning achievement test of 2 rounds.

Table 3. Result of comparison of thinking ability between pre-test and post-test experimental and control groups.

Group	n	Pre-test		Post-test		t	P
		\bar{X}	S.D.	\bar{X}	S.D.		
Experiment	30	26.90	6.04	31.60	5.44	-14.43**	.000**
Control	30	27.13	6.08	30.47	4.71	-5.23**	.000**

** Statistical significance level at .05.

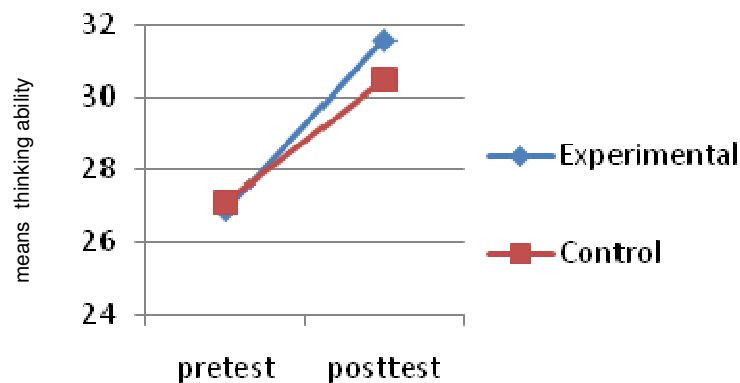


Figure 3. The means score of thinking ability test of 2 rounds.

Table 4. Result of comparison of learning achievement and thinking ability between experimental and control groups.

Criteria	Value	F	Hypothesis df	Error df	P	Partial Eta Squared
Wilk's lambda	.815	6.362	2.00	56.00	.003**	.185

** Statistical significance level at .05.

Table 5. Result of comparison of Learning achievement and Thinking ability between Traditional Classroom and CoBl.

Source	Sov	SS	df	MS	F	P
Learning achievement	Pretest	12.441	1.00	12.441	.730 12.246	.396 .001**
	Methods	208.724	1.00	208.72		
	Error	971.492	57.00	17.044		
thinking ability	Pretest	18.882	1.00	18.882	.693 .458	.409 .501
	Methods	12.431	1.00	12.431		
	Error	1547.844	57.00	27.155		

** Statistical significance level at .05.

an excellent level (= 4.78 , S.D. = 0.36).

DISCUSSION

The findings of this study can be discussed as follows. Considering the model of collaborative blended learning instruction through blended learning towards collaborative learning to implement the undergraduate students from institute of physical education, it was developed through principles, approaches, collaborative learning and blended learning, learning theory to develop thinking ability together with the survey on needs analysis both of traditional learning and online learning. There were four components; 1) principles, approach, and theories on which the developed instructional model is based, 2) objectives, 3) process of instruction, and 4) evaluation. There were three steps to instruct and manage learning activities as follows. step1) Pre-instruction: in this step learners were ready to learn through orienting, registering, grouping, doing pretest, and doing pre-test thinking ability; step 2). Instruction and thinking ability development with activities through primary seven scales in 9 sub-stages as follows.

Stage 1: Stated objectives and inform students of the learning objectives of the unit
 Stage 2: study the contents
 Stage 3: present situation

Stage 4: plan and determine choice: plan and determine ways to learn
 Stage 5: explorer / search: search and collect data for group members
 Stage 6: data analysis and synthesis
 Stage 7: conclusion and presentation of resolution
 Stage 8: evaluation and extended learning
 Stage 9: unit posttest and steps: 3) evaluation step: Learning activities of this step were learning achievement posttest and thinking ability posttest.

This developed instructional model of collaborative blended learning was a combination of traditional learning (face-to-face) and online instruction. This was related to the study of Richey (1986), Knirk and Gustafson (1986) which presented two steps of instruction; the instruction step and developing thinking ability step. This developed model also related to the study of Wannapiroon (2008) whose instructional model is composed of a variety of learning activities. Students were able to learn contents and curriculum activities anytime through learning tools provided by the learning management system as web board, chat room, and other internet learning resources as electronic mail and search engine. Students were encouraged to think and had to be active learners. This was related to the notions of Khammanee (2006) which stated that learning was cognitive and the mental process of a person in perceiving things. He or she tried to construct meaning from stimulus or gained experiences in order to understand things or situations. Taking active

and enjoyable learning activities, students got more engagement and more learning. Learning was fun and challenging. Variety of learning activities made students to be interested in participating in learning activities. This introduced continued learning to students and students could link and share their learning experiences effectively (Yi, 2005)

This developed instructional model of collaborative and blended learning promoted learning achievement and thinking ability among students. Empirically, posttest learning achievement score and thinking ability were statistical significantly higher than the pretest at the level of .01. This may be because students themselves performed searching and collecting useful problem solution related information from assigned learning resources both inside and outside online lessons including websites on internet through self-paced e-learning. The management of learning activities was designed to have students use their own account to log in the program. This was related to the notion of Dewey (1963) which stated that learning by doing would introduce students to improve their learning achievement and higher order of thinking ability. Learning activities of this model were based on learner-centered principles. The designed collaborative learning activities may increase learning achievement and thinking ability. The activation of learning through the discovery of students promote the classroom interaction; teacher-student, student-student, and self interaction. This also related to the study of Sevinc (2004) who stated that knowledge could be constructed through collaborative and blended learning which helped learners gain more learning achievement after having attended the program than before.

Students learned in a small group of 4-6 people. This also related to the study of Mills and Alexander (2013) who stated small group techniques as a way of dividing up larger classes, involving students in smaller groups working together; the larger the group, the more complicated the dynamics and the likelihood that some remain silent. This group size help all members of the group learn at their full learning capability. A group should comprise group members whose learning capability was different to diverse their thinking ability and capable friends who can help the less capable one. This would promote interaction among group members, such as giving opinion, consulting, suggesting, and making argument. This helped students develop knowledge and higher order thinking which related to the principles of social constructivism (Vygotsky, 1978). This appeared at planning and determining ways of learning step, analyze and evaluate learning outcome, summarizing and presenting learning outcome, and evaluation and extend learning outcome. According to planned learning activities, students have to attend online brain storming

activities. This related to the findings of Rovai and Jordan (2004) which found that blended learning brought awareness to students in participating learning community. Learning participations of each group members and part of group success activate learning among students. Students were energetic to learn (Garnham and Kaleta, 2002). This related to the notion that collaborative learning was a process to activate learning and suitable to solve complex problems. This makes students to attain social skills and knowledge sharing as learning experiences of each student. Successful learning depends on students' practice with unknown things and their own experiences in solving problems. These would improve learning achievement and thinking skills among students. This is related to the findings of Oliver (2006) who found that students who attended online learning and traditional classroom learning had positive attitude toward learning method. Moreover, this is also related to the finding of Johnson et al. (2006) who found that students who attended online blended learning improved their insight understanding in knowledge more than learning by online or traditional classroom learning only.

Students who conducted online testing can do the test repeatedly anytime and can solve the problem of assigned learning situation. Students were to present their answer on web board or send to the webpage on their own. This introduced meaningful learning by which students could memorize learned knowledge. This is related to law of exercise (Thorndike, 1913) which stated that permanent knowledge comes from repeated practice. Classroom environment promoted channels to search and find out additional knowledge and reviewed contents which helped learners construct knowledge themselves. This is related to learning environment design through social collaboration in self and group learning.

Learning achievement scores of students who attended this developed instructional model of collaborative blended learning was statistic significant higher than of the students who attended traditional learning. However, thinking ability as a whole and each item of the two groups was not different. The reasons may be because of the short time of implementation, for students took times to adapt themselves to get familiar with this new developed instructional model. Thinking ability was sprung from efficient instructional process and time consuming. Students lacked confidence to post their opinion. This may have ruined the opportunity to practice. This subject was not the core curriculum of physical education which worsened students' interests to attain the objectives of the course. This is related to achievement motivation of McClelland (1996) which stated that learning motivation is intrinsic motivation that drives a person to perform in order to attain goal or predetermined standard. In addition, most of the students were passive learners.

Conclusion

This CoBl based on collaborative learning and blended learning theory could promote thinking ability for Institute of Physical Education students. As current information age, the nature of teaching and learning is shifting to blended web-based instruction and traditional instruction, which includes face to face learning self-paced e-learning and live e-learning. Therefore, we should develop our thinking ability by using social constructivism. Teaching activities by this model is a combination between collaborative and thinking ability development. Results from the implementation of CoBl model found that students could develop their higher thinking ability.

Suggestions

1. Adoption of CoBl model based on collaborative and blended learning approach for thinking ability blended with the best features of the online learning and classroom learning must be prepared and allocated needed resources adequately and effectively such as software, computer laboratory, equipments of presentation, and the internet network.
2. Instructors and learners need to understand the process of teaching and learning. They have to participate in various activities in group activities and online discussion via chat and LMS to enhance the process of knowledge sharing.
3. Instructors take many roles such as facilitator, manager, planner, consultant, and assessors. Learning independently encourages learners to learn as designed activities of instructional model. Learners have to actively play a role and realize that learning is a duty. They should be interested in group activities and cooperative learning and sharing knowledge with group members.
4. To be successful in managing learning activities under the shade of this developed instructional model, there should be cooperation from many stakeholders such as administrators and teachers.
5. There should be study on the effects of this developed instructional model process such as critical thinking, problem solving, creative thinking, and analytical thinking.
- 6 There should lead current applications of social network which is interesting to students to cooperate with this instructional model to promote learning.
7. There should be study on the effects of the developed instructional model of collaborative blended learning with other groups of students, such as secondary and graduated students.
8. There should be assimilation on the effects of the developed instructional model to teachers at all educational levels in order that they can improve students' learning experiences.

Conflict of Interests

The authors have not declared any conflict of interests.

ACKNOWLEDGEMENT

The author thanks Institute of Physical Education for financial support.

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