Effects of using problem-based learning activities via internet on self-directed learning and achievement of higher education students

A. Satiman ¹ S. Boonlue ² and T. Sittiwong ³

¹ Department of Educational Technology, Faculty of Education, Silpakorn University, Nakhonpathom, Thailand
(sanirut@su.ac.th)

² Department of Education Communication and Technology, Faculty of Industrial Education and Technology, King Mongkut's University of Technology Thonburi, Bangkok, Thailand
(surapon@hotmail.com)

³ Department of Education Communication and Technology, Faculty Education, Naresuan University, Pitsanulok, Thailand
(s_thiparat@hotmail.com)

ABSTRACT
The purposes of this research study were:
1) to study an online instruction by problem-based learning activities via internet, 2) to compare pretest and posttest of learning achievement students who received the online instruction by problem-based learning activities via internet, 3) to compare pretest and posttest of self-directed learning students who received the online instruction by problem-based learning activities via internet, 4) to compare self-directed learning and learning achievement between the online instruction by problem-based learning activities via internet and the traditional problem-based learning activities, and 5) to study the students satisfaction toward the online instruction by problem-based learning via internet. The subjects were 92 students who were enrolled in the computer for education course, during the second semester of the academic year 2007, the Faculty of Education, Silpakorn University. Two classes were assigned to the experimental group (n=46) and control group (n=46) by simple random sampling. Data were analyzed by using mean, standard deviation, and t-test statistics. Results of the research were as follows:
1) The developed online instruction model by problem-based learning activities via internet should be included the 5 principal components and 16 subcomponents. Design of problem-based learning method was approve by a panel of experts. Efficiency of the online instruction by problem-based learning activities developed the researcher was 80.22/84.22 that compounded with the criteria. 2) Posttest of the learning achievement of online instruction by problem-based learning activities was higher than pretest at.01 level of significance. 3) There was significant difference of learning achievement between online instruction by problem-based learning activities and the traditional problem-based learning activities. 4) There was non significant between pretest and posttest of self-directed learning score of online instruction problem-based learning activities. There was non significant difference of self-directed learning between the online instruction by problem-based learning activities via internet and the traditional problem-based learning activities. 5) The students who learn via online instruction by problem-based learning activities on law and ethics in information technology lessons had high satisfaction.

Keywords:
Problem-based learning via internet, self-directed learning, achievement, higher education
1) INTRODUCTION
Thailand education focuses on the development of information technology for education in order to keep up with the changes in both society and economics. This could be seen in the National Education Act B.E. 2542 which states that there should be an application of technology for education in order that the personnel have knowledge and ability to use appropriate technology with quality and efficiency. Educational technology will help learners learn in a broader sense, faster so that they can learn anytime and anywhere. The learners are free to search for knowledge and responsible for themselves. This allows the learners to learn according to their potential which can meet each individual's need.

Education at the present time contains a lot of contents in a limited time. Instructors, therefore, choose to lecture and present only what they consider as essential for their work. Some contents are already old. The instruction is mainly instructor-based, that is to say, the instructors choose the contents, the teaching method, the suitable time and duration. They decide who passes or fail the tools the instructors developed. As a result, most learners learn by remembering and following the contents that the instructors provided. They will not develop skills in thinking, doing survey and applying their knowledge in their real work because educational technology changes rapidly. New instructions replace old ones along with learning activities as well as teaching method which progress to great extent.

More importantly, the instruction done by the teaching staff must require practical skills along with knowledge from many fields. During real work, they must encounter the diversity of situations and problems. If learners do not practice differently from the instruction, they might not be able to work in real life. The instruction to develop the personnel to enter this career, therefore, must be based on problem-solving skill by right procedure. This new procedure for problem-solving skill consists of content integration for many subjects. Educational management must focus on skills like searching for new knowledge and solutions. The learners must be taught what and how to select their own lessons in order to become up-to-date with the present situations in the real world which they must face after graduation. The learners must also realize that what contents are useful for their work and how they can learn without instructors. Learning to learn is what we should focus (Ruecha, 1993).

Self-directed learning or SDL is a process in which learners initiate their own learning by considering their own need for study, setting goals and learning materials, contacting others, searching for knowledge, choosing learning method, and evaluating their own learning achievements which can be under the supervision by others. Learners learn better when they learn by themselves instead of waiting for the contents provided by the instructors because they have high intentions and motivations. They are independent and able to lead their own life (Knowles, 1975). It is widely acknowledged that the important characteristics which need to be developed in everybody is to incubate learners to learn by themselves and learn all the time. This is called "Lifelong Learning" which is the result done by the organizations responsible for the education in all level. The fundamental philosophy of higher education is to search for and share the knowledge in order to find newer one which is beneficial for the development of academy and society. In reality, however, the learning method most learners use is still based more on remembering than on analysis and creativity. Knowles (1975) says that the roles of instructors are to create learning atmosphere, plan, analyze the learners' need, set goals, design learning plan, participate in learning activities, and evaluate the learners' learning results. The learners must be independent in searching for knowledge and being responsible for their own learning activities. This can be done by using packaged material or by themselves like reading, thinking, testing and doing by them (Jen-obrom, 1989).

Problem-based learning or PBL is a learning activity which originates from the learning theory called "Constructivism" which allows students to create new knowledge from the actual problems in the real world as their learning context so that the learners have skills in thinking and solving problems. They also use their knowledge according to their field of study. Problem-based learning is, therefore, the
result from working process which depends on understanding and solving problems (Thammabut, 1992). The role of instruction is no longer based on instructors because instructors are to design activities for learners in the form of problem and provide learners with learning resources so that learners can learn by themselves along with their instructors as their facilitators (Hongladarom, 1997). Problem-based learning, therefore, focuses on student-based learning in which the learners search for knowledge required to solve the assigned problems according to the procedure and steps as well as actual knowledge. This makes learners able to apply their knowledge in real life.

Online Instruction is different from the traditional instruction in classroom in that traditional instruction is based on instructors. The instructors explain and express their own opinions; students do not have time to express their opinions and ask their questions because there are too many students in class. The instruction is limited by time. The students who are different from others are not brave enough to show themselves. There are too many contents to learn in each day, resulting in no connection between the lessons. The electronic online instruction can facilitate learners by allowing them to set their own schedule as required and giving them flexibility to link much information. This kind of instruction can save time up to 50% and reduce the cost up to 30-60%. Moreover, internet network allows learners to participate in many learning activities. This will result in community of learner (Anderson, 1994).

This research aims to study problem-based learning activities which include both PBL and online instruction in order to support instructional activities by using technology, developing self-directed learning and adding new channels to instruction.

2) OBJECTIVE

1) To develop online instruction by problem-based learning activities on law and ethics in information technology lessons
2) To compare pretest and posttest of learning achievement of students who studied online instruction by problem-based learning activities on law and ethics in information technology lessons
3) To compare pretest and posttest of self-directed learning of students in experimental group who studied online instruction by problem-based learning activities on law and ethics in information technology lessons and students in control group who studied the traditional problem-based learning activities
4) To study the students’ satisfaction towards the online instruction by problem-based learning activities on law and ethics in information technology lessons

3) RESEARCH METHODOLOGY

The sampling group used in this study was composed of 130 first-year students who enrolled in the 468102 computer for education course during the second semester of the academic year 2007, the Faculty of Education, Silpakorn University. 92 were chosen by simple random sampling method. There were two groups as the experimental group and control group, in each of which there were 46 students. This research was done in accordance with the following research and development procedure:

This research was done in accordance with the following research and development procedure:

3.1) Step 1

The problem-based learning activities on law and ethics in information technology lessons and the efficiency of online instruction was developed by the researcher. This started with the literature review on online instruction by problem-based learning activities, principles, concepts, instruction process, designing activities, measuring and evaluating methods. Both local and international documents were studied, analyzed and put into a summary after structured interview with experts. The procedure for online instruction by problem-based learning activities was achieved. The elements were then set as the concepts to design the online instruction. 12 experts in curriculum and teaching reviewed and evaluated
the appropriateness of elements and procedure for online instruction by problem-based learning activities. The results were as follows:
The review and evaluation by the experts in terms of appropriateness of elements and procedure was in overall at high level ($\bar{X} = 4.30$, SD=.46) (The average score above 3.51 can be counted as applicable; the items with lower score must be considered for revision).

3.2) Step 2
The development of research tools for online instruction by problem-based learning activities on law and ethics in information technology lessons. To develop online instruction, the design was done in the first place by analyzing the structure and the website in terms of specifying the contents, analyzing the contents on law and ethics in information technology along with learning objectives, learning achievement tests and then the accuracy of the contents which was evaluated by 3 experts in the contents. The consistency of the contents and the objectives was evaluated using index of concurrence (IOC). After the evaluation by the experts in 4 dimensions, it was found that the average score of the contents yielded appropriate result ($\bar{X} = 0.89$). After an analysis of the contents, the scope of the contents in terms of main topics and subtopics were put into the content structure and the website was completed and then was put to quality evaluation by the experts in online instruction and educational technology. The quality of online lessons was evaluated using the questionnaire on online lesson quality. The result for the online instruction by problem-based learning activities on law and ethics in information technology lessons yielded highly appropriate ($\bar{X} = 4.30$, SD = .32).

3.3) Step 3
The contents which were approved by a panel of experts were to be measured in terms of efficiency by students who enrolled in the computer for education course for the chapter entitled “law and ethics in information technology” at the following URL: http://202.44.14.13/PBL3U. The steps to find out the efficiency of online instruction consisted of 3 steps as follows: one-to-one test which was done with 3 students outside the sampling group to find out quality at the first place; small group tryout which was done with 12 students to find out the efficiency of the contents and quality in terms of objectives to get information for revision; and field tryout which was done with 30 students to find out the efficiency of the developed online instruction by problem-based learning activities. The result of efficiency analysis of online instruction by problem-based learning activities was that E1 /E2 were 80.22/84.22 respectively that means it passed the criteria.

3.4) Step 4
The comparison of learning achievement of self-directed learning and the satisfaction towards the online instruction by problem-based learning activities on law and ethics in information technology lessons

4. Research Results
1) The research result was that the comparison of pretest and posttest of learning achievement of online instruction by problem-based learning activities on law and ethics in information technology lessons showed that posttest learning achievement was higher than pretest at the .01 level of significance. Therefore, online instruction by problem-based learning activities enhanced learning achievements of learners (as shown in Table 1).
Table 1: The comparison of pretest and posttest of learning achievement

<table>
<thead>
<tr>
<th></th>
<th>Score</th>
<th>N</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>46</td>
<td>14.10</td>
<td>3.83</td>
<td></td>
<td>-15.36**</td>
<td>.000</td>
</tr>
<tr>
<td>Posttest</td>
<td>46</td>
<td>23.17</td>
<td>3.94</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: **p<.01

2) The analysis of learning achievement of posttest of students who used online instruction by problem-based learning activities and learning achievement of posttest of students used problem-based learning activities in classroom showed that it was different at the .01 level of significance. Problem-based learning activities in classroom showed higher average score than online instruction by problem-based learning activities. After considering the overall score of 2 methods, it was found that both learning achievements were not quite different. Therefore, both methods can be applied for the instruction in accordance with the appropriateness and the needs (as shown in Table 2).

Table 2: The comparison of posttest learning achievement Experimental group students who used online instruction and Control Group students who used PBL Traditional Classroom

<table>
<thead>
<tr>
<th></th>
<th>Score</th>
<th>N</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBLOnline Instruction</td>
<td>46</td>
<td>23.17</td>
<td>3.94</td>
<td></td>
<td>-3.581**</td>
<td>.001</td>
</tr>
<tr>
<td>PBLTraditional Classroom</td>
<td>46</td>
<td>25.69</td>
<td>2.69</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: **p<.01

3) The analysis of pretest and posttest of self-directed learning of the experimental group using online instruction by problem-based learning activities showed that posttest of learning achievement was different from pretest without significance. The average score of posttest for the sampling group in terms of self-directed learning increased only a little compared to pretest.

4) The comparative analysis of posttest of self-directed learning of experimental group students who used online instruction by problem-based learning activities and control group students who used problem-based learning activities in classroom showed that self-directed learning for both experimental group and control group was different without significance. It could be concluded that both kinds of problem-based learning activities yielded the same self-directed learning (as shown in Table 4).

Table 4: The comparative analysis of posttest of self-directed learning Experimental Group and Control Group

<table>
<thead>
<tr>
<th></th>
<th>Score</th>
<th>N</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBLOnline Instruction</td>
<td>46</td>
<td>3.44</td>
<td>.30</td>
<td>.576</td>
<td>.566</td>
<td></td>
</tr>
<tr>
<td>PBLTraditional Classroom</td>
<td>46</td>
<td>3.47</td>
<td>.23</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5) The students’ satisfaction towards the online instruction by problem-based learning activities on law and ethics in information technology lessons which was done by the students who completed the online instruction by problem-based learning activities showed that the students’ satisfaction (the average score) towards the online instruction by problem-based learning activities on law and ethics in information technology lessons was at high level ($X = 3.84, SD = .39$)

5. CONCLUSIONS AND DISCUSSIONS

1. The development of online instruction by problem-based learning activities was done in a systematic and step-by-step manner because problem-based learning activities were new to be developed online. Therefore, it was important to develop the steps and procedure in the most appropriate level which was evaluated by the experts. The development of such activities complied with the research and development procedure by using information technology and new method (Chaicharoen, 2004) and student-based learning and constructivism. proposes that the developed instruction must provide learners with all information. This complied with Kaemanee (1998) who says systematic instruction depends not only on philosophy, theories, and concepts but also on various techniques to enhance the efficiency of the online instruction by problem-based learning activities. The developed online instruction passed the criteria set at 80/80. That means the developed online
instruction could be used as instruction activities. Sikhabundit (1995) says that media creation needs tryout and revision to pass the standards before it can be used with real population. The development of online instruction by problem-based learning activities followed such procedure and process; therefore, the efficiency passed the criteria.

2. The results from the development of online instruction by problem-based learning activities helped learners achieve the set objectives in terms of learning achievement. The experimental group who used the online instruction by problem-based learning activities showed higher learning achievement. This complies with Dejakup (2003) in that instruction which allows learners to think in a systematic way instead of remembering will help learners think analytically, synthesize and build bodies of knowledge to develop their own thinking skills. Besides, problem-based learning activities must be done individually, that is to say, the students will become active learners. They are different from the learners in traditional classroom (passive learners) in that passive learners wait for the contents. The activities or problems they are given are stimulus or what drives learners to learn. As for learning achievement, it complies with the research done by Saiseesod (2001) which studied the development of instruction system by internet for Rajabhat Institute. The finding was that posttest of learning achievement by online lessons was higher than pretest at .05 level of significance. Horpaisarn (2001) studied the development of online lessons on general subjects to increase learning efficiency of the learners and found that the developed online lessons helped the experimental group achieve higher average posttest, self-directed learning and ethics than the control group. However, creativity and academic learning achievement of the experimental group was lower than the control group. After the lessons, the average score of self-directed learning, critical thinking, ethics and morals was higher than the pretest at the .05 level of significance.

3. According to the comparative study of learning achievement of the experimental group who used online instruction by problem-based learning activities and the control group who used problem-based learning activities in traditional classroom, it was found that they were different at the .01 level of significance. Problem-based learning activities in traditional classroom (the control group) showed higher average posttest score than online instruction by problem-based learning activities (the experimental group). If both instructions were considered in terms of overall score, it was found that both were not quite different. Both can be applied for instruction according to the appropriateness and the need. That means the developed online instruction by problem-based learning activities can replace and be used along with problem-based learning activities in traditional classroom. Chaicharoen (2004) suggests that the instruction which integrates media attribution, especially knowledge linked to other nodes in an unlimited way, will be a background for building new bodies of knowledge and broaden learners’ thinking skills. Online instruction is open for learning and building bodies of knowledge because learners will think and participate as well as interact all the time (Dabbagh and Bannan-Ritland, 2005). This complies with Hopaisarn (2001) in that online instruction is as effective as traditional classroom but traditional classroom has limitations like schedule needs to be fixed, there should be not too many students and the location might be too far and too small for students. Online instruction solves the above-mentioned problems. Poosuwan and Namchaiprasert (2003) suggest that online instruction is helpful for students since they can choose when to learn. They are satisfied with independent and flexible learning style. Online instruction (e-Learning) reduces the time wasted for learning over 50% and reduces the cost up to 30-60%.

4. As for self-directed learning, the study results revealed that self-directed learning of the experimental group and the control group was not different. Both instructions yielded the same self-directed learning. The comparison of pretest and posttest of the experimental group who used online instruction by problem-based learning showed no significant difference. The average scores of posttest of both groups increased a little. Therefore, both instructions can be used according to the preparedness and the appropriateness in order to develop the desired students’ characteristics. The reason...
why self-directed learning scores were not different might be because online instruction needs independent study (Maneekul, 2004) and creativity (Chaicharoen, 2004). Online instruction requires that students become active learners who really participate in activities in order to broaden their knowledge. The duration of both instructions was 4 weeks and there were only 2 problems, resulting in little changes in many characteristics. Watanawilai (2005) says that problem-based learning is considered as difficult and time-consuming. Learners get confused about what they analyze. The instructors must act as facilitators along with online instruction which emphasizes student-based learning (Ministry of Education, 2002). The steps for instruction start with the learners and in each step there are activities for students to search for knowledge from problems. This opens an opportunity for learning and they will love to learn by themselves through planning, working in groups and sharing knowledge. Online instruction by problem-based learning activities, therefore, requires students to be responsible for their activities. Knowles (1975) says that self-directed learning will show obviously when the learners have enthusiasm to learn in learning-friendly environment. Olgren (1998) also says that self-directed learning involves understanding in missions, learning procedure, responsibilities, duration and self-control in terms of learning.

REFERENCES


