Abstract: In the current era of globalization, many efforts were made to improve the learning process. Critical thinking with strategies and media of learning and educational technology has changed the world for the better. This study aims to determine the increase learning outcomes and student activities on chemistry learning using problem-based learning with media concept maps and computer-based learning. The population in this study is a first year student of Chemical Education, University of Riau. The research sample is 2 non-regular classes. Learning activity hypotheses obtained Sig. (2-tailed) > α = 0.05, so there is no significant difference learning activities students are taught using problem-based learning that are integrated with the concept maps than computer-based learning. The hypothesis of learning outcomes obtained Sig. (2-tailed) > α = 0.05, so there is no significant difference in student learning outcomes taught using problem-based learning integrated with the concept maps with the computer-based learning. Learning outcomes is in the form of Gain normalized. Both of these media, concept maps and computer-based learning, integrated with problem-based learning can increase the activity and learning outcomes. Nevertheless, in terms of learning gains and learning activities concepts maps had the highest average number, followed by the computer based learning.

Keywords: learning activities; learning outcomes; computer-based learning; concept maps; problem-based learning.

1. Introduction

Most students consider the subjects of chemistry as a subject less attractive and boring [15]. There are some things that allegedly causes a lack of mastery of basic chemicals include: (1) Students often learn by rote so do not understand the material being studied; (2) The floating material taught so that students cannot find the key to understand the material being studied; and (3) Lecturer less successfully convey the concept of the material being taught [12].

A lecturer should be able to convey the subject matter and be able to develop the topic of the lesson so that the achievement of the optimum student learning outcomes [1]. Teachers should actively involve students in the learning process by utilizing instructional media as tools for optimizing learning objectives. Some media education that is often used in the teaching-learning process media including print, electronic, models, sketches, maps and diagrams. The use of instructional media cannot be applied without learning strategy, so it needs a combination of learning strategies appropriate to the instructional media [20].

Concept maps and computer-based learning issues to the fore and engage students in active, while learning strategies related to problem one of them is a problem-based learning. Problem-based learning are described as active learning strategies that provide students a framework for self-development, critical thinking so as to obtain information. This learning strategy can be modified for
all materials. Problem-based learning gives learners the opportunity to be actively involved in the learning process [2].

Concept maps can be used as a medium of learning from schools to universities. Concept maps can serve as: (a) learning strategies to improve comprehension and memory of students, encouraging cooperative and collaborative learning, encouraged to solve problems, think critically and learn transformative: (b) tools to facilitate the organization of curriculum development and programs; and (c) tools for evaluation and assessment. Concept maps can help students understand the material is complicated, integrate prior knowledge with new knowledge, and engage students in learning with conceptual materials so that students understand that learning will be more meaningful [11]. Map concept is a practical method to determine the relationship between concepts, sharpen their conceptual understanding and improve their critical thinking [9]. Similarly, the computer media can be designed and used so as to make the learning that emphasizes the problem and train the student's ability to solve problems and find solutions [5].

In this study the problem can be formulated as follows:

1. Is there a significant difference in learning activities students are taught using problem-based learning that are integrated with concept maps compared to learning activities students are taught using problem-based learning that are integrated with computer-based learning?
2. Is there a significant difference in learning outcomes of students who are taught using problem-based learning that are integrated with concept maps compared to learning outcomes of students who are taught using problem-based learning strategies that are integrated with computer-based learning?

Objectives to be achieved in this research are to determine:

1. Is there a significant difference in learning activities students are taught using problem-based learning that are integrated with concept maps compared to learning activities students are taught using problem-based learning that are integrated with computer-based learning.
2. Is there a significant difference in learning outcomes of students who are taught using problem-based learning that are integrated with concept maps compared to learning outcomes of students who are taught using problem-based learning strategies that are integrated with computer-based learning.

With the restrictions on the problem, then the problem to be studied will be more focused and targeted. In order for this research more focused and targeted, the researchers made the boundary problem as follows:

1. Learning media used is the concept maps and computer-based media.
2. The learning strategy used is the strategy of problem-based learning.
3. To study basic chemistry course focused on learning of Chemical Kinetics.
4. The subject of the study is the first year student of University of Riau.
5. Restrictions on the activities carried out and the results of student learning.

2. Literature Review

Problem-based learning is a teaching process that is exploratory and self-directed. Emphasis on problem-based learning is self-learning that encourages students to develop their skills. Thereby enabling learners take responsibility for their own learning experience[13].

Gultom [4], examined the effectiveness of media concept maps in teaching calculus functions on the course and obtain a result of research that concept maps can improve student learning outcomes. In this study, not only of learning outcomes is the purpose of the study but researchers also saw students during the learning activity undertaken. Map concept makes learning meaningful for students [14]. Thus the concept maps very closely related to learning that emphasizes the problem, so it is suitable when concept maps are integrated with problem-based learning strategies.

The use of ICT in education is one of the major turning point and a reason to produce thinking pedagogical changes in many institutions of higher learning. Various methods Belar-teaching involves computer-based learning [18], Shung Tai [17], proved that e-learning is very suitable to stimulate interest in the matter and the motivation of learners. In this study, e-learning was done on problem-based learning with computer-based learning to see the activities and results of student learning.
3. Methodology

This research was conducted in Chemical Education Studies Program, University of Riau Academic Year 2010/2011. The study population is students the second semester (two) Chemical Education Studies Program, University of Riau. Samples are non-regular students Chemical Education, University of Riau, where the non-regular classes totaling 43 students B1 and B2 non-regular amount to 45 students, so that the total sample of 88 students.

Data was collected using achievement test and observation sheet student learning activities. Before carrying out the study, first conducted trials test instrument research that aims to determine the level of validity, difficulty index, different power and reliability of the test instrument. Tests on this study are given twice, pretest and posttest. Objective test (multiple choice) is a test in examination can be conducted objectively.

<table>
<thead>
<tr>
<th>Table 1. Research Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
</tr>
<tr>
<td>E₁</td>
</tr>
<tr>
<td>E₂</td>
</tr>
</tbody>
</table>

Information: :
E₁: Class that learned with problem-based learning using concept maps media.
E₂: Class that learned with problem-based learning using computer-based media.
T₁: pretest (initial test)
T₂: Postes (final test)
X₁: Learning to use a problem-based learning media concept maps.
X₂: Learning with problem-based learning using computer-based media.
A₁: Activities of students that learned with problem-based learning using concept maps media.
A₂: Activities of students that learned with problem-based learning using computer-based media.

Data analysis techniques used include: 1) testing the homogeneity of the data used to test the One-Way ANOVA in SPSS 17 for windows, 2) testing the normality of the data were performed using SPSS 17 for windows with the Kolmogorov-Smirnov test, and 3) testing the hypotheses used Independent sample T-test two parties in SPSS 17 for windows.

4. Results and Discussion

Before testing the hypothesis, data must meet pre-requisite. There are two prerequisite that must be met in order for a hypothesis test can be done i.e. normality and homogeneity test. The data used is the average and standard deviation. Data normality test is done to check whether the data of research variables normal distribution or not, that is to say whether the dissemination of data in the population is normal. Normality test is done by using SPSS 17 for windows with the Kolmogorov-Smirnov test. Testing criteria are sig> α then the data are normally distributed.

<table>
<thead>
<tr>
<th>Table 2. Results of Normality Test Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
</tr>
<tr>
<td>PBL+Maps Concept</td>
</tr>
<tr>
<td>PBL+Computer</td>
</tr>
<tr>
<td>PBL+Maps Concept</td>
</tr>
<tr>
<td>PBL+Computer</td>
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<tr>
<td>PBL+Maps Concept</td>
</tr>
<tr>
<td>PBL+Computer</td>
</tr>
</tbody>
</table>
Based on Table 2 above can be seen that in both classes sig> α so that it can be concluded that the data pretest, posttest, gain and learning activities of students of both the experimental class are normally distributed.

In this study to test the homogeneity of the data used One-Way ANOVA test on SPSS 17 for windows. The data used is the value pretest, posttest, gain and learning activities both experimental class. Testing criteria are sig> α, it can be stated at the time of the pretest, the experimental class have the same variance (homogeneous).

<table>
<thead>
<tr>
<th>Data</th>
<th>Average</th>
<th>Standard Deviation</th>
<th>Sig</th>
<th>A</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td>$\bar{X} = 45.0568$</td>
<td>SD = 14.15218</td>
<td>0.568</td>
<td>0.05</td>
<td>Homogen</td>
</tr>
<tr>
<td>Postest</td>
<td>$\bar{X} = 79.4886$</td>
<td>SD = 10.31236</td>
<td>0.389</td>
<td>0.05</td>
<td>Homogen</td>
</tr>
<tr>
<td>Gain</td>
<td>$\bar{X} = 0.6534$</td>
<td>SD = 0.14460</td>
<td>0.077</td>
<td>0.05</td>
<td>Homogen</td>
</tr>
<tr>
<td>Learning activities</td>
<td>$\bar{X} = 58.2591$</td>
<td>SD = 11.09533</td>
<td>0.842</td>
<td>0.05</td>
<td>Homogen</td>
</tr>
</tbody>
</table>

Based on Table 3 above it can be seen that the data pretest, posttest, the gain of learning outcomes and learning activities of students have a homogeneous data.

Having in mind that the normally distributed data and has the ability to start homogeneous, it can test the hypothesis. To test the hypothesis used independent sample T-test two parties in SPSS 17 for windows. Overall the hypothesis test result data can be summarized as in Table 4 below.

<table>
<thead>
<tr>
<th>No</th>
<th>Data</th>
<th>Sig. (2-tailed)</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Learning activities</td>
<td>0.774</td>
<td>0.05</td>
</tr>
<tr>
<td>2</td>
<td>Learning outcomes</td>
<td>0.461</td>
<td>0.05</td>
</tr>
</tbody>
</table>

From the data processing activities of learning (PBL Concept Maps) and (PBL + Computer) obtained Sig. (2-tailed) 0.774> α = 0.05, so there are no significant differences in learning activities students are taught using problem-based learning that are integrated with concept maps compared to learning activities students are taught using problem-based learning that are integrated with computer-based learning. From the results of hypothesis testing can be concluded that by using problem-based learning, integrated media concept maps and computer-based media can improve learning activities in the study of chemical kinetics. This is in line with research Law, et al [10] with research on motivation in learning facilitated e-learning computer programming courses, the results of research showing that both facilitated e-learning using a computer can improve student learning motivation and effectiveness. Wu, et al [19], in his research entitled a study of student satisfaction in a blended e-learning system environment explained that e-learning can improve students’ learning satisfaction. Research Kolkman [8], with the research entitled mental model of mapping as a new tool to analyze the use of information in decision-making in integrated water management, successfully concluded that the concept maps can stimulate the learning process and being able to visualize the knowledge to analyze the difficulties in the problem solving process and is able to convey communication information between teachers and students. At the time of the learning process researchers had no
difficulty in delivering the materials. This is due to the learning media concept map for the experimental class 1 and class computer-based media to experiment 2. With the use of instructional media researchers can sense the activity of the students who are enthusiastic to follow the material presented.

Based on Table 4 to test the hypothesis of learning outcomes obtained by the Sig. (2-tailed) \(0.461 > \alpha = 0.05\), there is no significant difference learning outcomes of students who are taught using problem-based learning that are integrated with concept maps compared to learning outcomes of students who are taught using problem-based learning that are integrated with computer-based learning.

From the results of hypothesis testing can be concluded that by using problem-based learning, integrated media concept maps and computer-based learning to improve learning outcomes in the study of chemical kinetics.

The achievement of learning outcomes in the form of N-Gain the experimental class 1 (PBL + Concept Maps) of 0.66 and an experimental class 2 (PBL + Computer) of 0.64, this proves the improvement of learning outcomes by using maps concept and computer based learning. Improved student learning outcomes using PBL + Maps concept are not much different from the learning outcome of students that teaching using PBL + computer-based learning at study chemical kinetics. From these results it can be concluded media concept maps and computer-based learning to improve learning outcomes in the study of chemical kinetics with no one to surpass each other. This finding is consistent with research Johnstone and Otis [7], with a study entitled concept mapping in problem based learning: a cautionary tale explains that students who used media concept map scores better job than the students who did not use media concept maps. Cukusic research, et al [3] investigated the existence of a clear relationship between the planning and control of the process of e-learning and learning outcomes. Hogo [6] with a study entitled evalution of e-learning systems based on fuzzy clustering models and statistical tools, stating that the system of e-learning ability of students from bad to better.

During the learning process the students were divided into several groups. In each group is given an evaluation and training, data showed the value of the group shown in Figure 1.

![Figure 1. Value Evaluation Group (PBL+Computer) and Group (PBL+Maps Concept)](image)

Group evaluation value is processed using SPSS 17 for windows of the obtained output shown in Table 6. From these data it can be seen the average value of the evaluation of the experimental class 1 (PBL + Concept Maps) 86.5250 and experimental class 2 (PBL + Computer) 85.4556. Students in the group looks serious about exercise and talk to each other about each other. Experimental class 1 and class 2 had an average value of evaluation is relatively the same. Nevertheless, in terms of value evaluation group, concepts maps had the highest average number, followed by the computer based
learning. This is consistent with research Smith et al [16] result suggest that maps may be superior to computers games as preparation for spatial reading.

Table 5. Output Processed Data Value Evaluation Group

<table>
<thead>
<tr>
<th>Descriptive Statistics</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>experimental class 1</td>
<td>8</td>
<td>76.90</td>
<td>100.00</td>
<td>86.5250</td>
<td>7.97026</td>
</tr>
<tr>
<td>experimental class 2</td>
<td>9</td>
<td>76.90</td>
<td>100.00</td>
<td>85.4556</td>
<td>7.14530</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

During the learning process, learning activities both classes experimentally observed by 2 observers. From the observation observers note that there is no significant difference between classroom learning activities experiment 1 and experiment 2. Students from both the experimental class enthusiastically following study of chemical kinetics. Based on the results obtained, it can be said that the implementation of problem-based learning integrated media concept maps and computer-based learning that performed the study of chemical kinetics can increase the activity of learning and learning outcomes. Nevertheless, in terms of learning gains and learning activities concepts maps had the highest average number, closely followed by the computer based learning.

5. Conclusion

Media and learning strategies are used to improve the activity and learning outcomes. In this study, the comparison of two media namely concept maps and computer using PBL are conducted. This study demonstrates that there are no significant differences in learning activities and learning outcomes students taught using problem-based learning integrated with concept maps compared to learning activities and learning outcomes students taught using problem-based learning integrated with computer-based learning. Nevertheless, in terms of learning gains and learning activities concepts maps had the highest average number, closely followed by the computer based learning.

This study only uses two classes, one class for media concept maps + PBL and 1 classroom for computer + PBL. Further research needs to be done with larger samples and using at least three classes, one for the control class so that it can be seen the effectiveness of the concept maps and computers.

References

[9] Korganci, Nuri; Miron, Cristina; Dafinei, Adrian; Antohe, Stefan., “Comparison Of Generating Concept Maps And Using Concept Maps On Students Achievement” The International Scientific Conference
Concept Maps Versus Computer Based Learning: Comparing Problems Based Learning In Chemistry Course


