Improvement of the Ability of the Students in an Education Program to Design the Lesson Plans by Using an Instruction Model based on the Theories of Constructivism and Metacognition

S. Janjai*
Curriculum and Instruction Program, Faculty of Education, Nakhon Pathom Rajabhat University, Nakhon Pathom 73000, Thailand

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Abstract

A number of students who are educated to be primary and secondary school teachers still have problems in designing lesson plans. In this research, an instruction model for improving the ability of students in designing the lesson plans was developed. The instruction model was based on the theories of constructivism and metacognition. The research activities consist of 4 steps as follows. Firstly, a learning unit was created by using the backward design approach. Secondly, an instruction model was designed by employing the theories of constructivism and metacognition. Based on this instruction model, the lesson plans of the learning units were prepared for teaching the students. Thirdly, 18 students of Nakhon Pathom Rajabhat University were taught by using this instruction model for one semester. Finally, the ability in designing the lesson plans of these students were evaluated. The evaluation was based on the achievement of the study and the quality of the lesson plans produced by these students. It was found that the ability in designing the lesson plans of the student after being taught by using this instruction model was significantly improved. In addition, the lesson plans obtained from 33.3%, 50.0% and 16.7% of the total students were evaluated to be in the very good, good and moderate levels, respectively.

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* Corresponding author. Tel.: +66-34-261064; fax: +66-34-261064.
E-mail address: janjai083@gmail.com.
1. Introduction

The first national education act of Thailand was declared in 1999. It strongly promoted the education reform of the country, including the reform of educational system for producing teachers for primary and secondary schools. After this act had come into force for 10 years, its effectiveness of the reform was evaluated. The evaluation results revealed that there was a good progress in a structural reform of the educational system. However, there were still a number of problems in the educational systems. For examples, learning achievement in main subjects such as Mathematics, Science and Thai language of students were low and students lacked motivation in seeking new knowledges. These indicate unsatisfactory outcome of the educational reform during the first decade of the implementation of the national education act. To response to these problems, the Ministry of Education proposed several measures to fulfill the education reform. The development of competent teachers is also included in these measures.

Nakhon Pathom Rajabhat University (NPRU) is one of higher education institutions which produces teachers for the educational system under the education reform. NPRU offers a program in education toward a bachelor degree in education. The normal period of this study is 5 years. After graduation, students who obtain this degree can work as teachers in primary and secondary schools.

A graduate of this program is expected to be a competent teacher in a school under the education reform. Such a teacher must be capable of designing good lesson plans using for the effective instruction. However, several research findings indicated that school teachers still have problems of preparing qualified lesson plans [1]. The improvement of the ability in preparing good lesson plans is essentially required.

The objective of this research is to develop an instruction model based on the theories of constructivism and metacognition for improving the ability of students in designing the lesson plans.

2. Methodology

This study was carried out at NPRU and the students subjected to this investigation are those who attend the science teaching program of the Faculty of Education of NPRU. Eighteen students of this program were subjected to this investigation. These students studied in the subject of the principle of teaching and learning management of the program. This research methodology consists of the 4 steps as follows.

Step 1. Development of the learning units by using the backward design approach [2]. The course description of the subject was analyzed. The learning outcome of each unit and evaluation parameters were defined. Prior to the utilization, the units were evaluated by experts in this field.

Step 2. Design of instruction model by using theories of constructivism and metacognition [3]. Based on the theories, learning activities (Table 1) and steps of teaching together with the roles of the instructor and students (Table 2) were proposed.
Table 1. Learning activities designed by using theories of constructivism and metacognition.

<table>
<thead>
<tr>
<th>Principle of learning</th>
<th>Learning activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Construction of new knowledge</td>
<td>1. Request the students to describe their background experiences on the subject to be learned. Encourage the students to propose the method for learning new knowledge according to their interest and competency.</td>
</tr>
<tr>
<td>2. Authentic learning</td>
<td>2. Let the students face real situations, such as problems in the classroom.</td>
</tr>
<tr>
<td>3. Activity-based approach</td>
<td>3. Request the students to construct the knowledge by themselves from various activities such as the study from documents, survey, interview and experiments.</td>
</tr>
<tr>
<td>4. Group process and member interaction</td>
<td>4. Assign the students to work together as groups, each of which has 4-6 students. Each member of the group has a specific role and mission. The outcome of the work was evaluated by all members of the group. 5. Request the students to use the rule of “PDCA” (Plane, Do, Check and Action) to control their work to achieve the goal.</td>
</tr>
</tbody>
</table>

Table 2. Step of teaching and roles of the instructor and the students

<table>
<thead>
<tr>
<th>Steps of teaching</th>
<th>Role of the instructor</th>
<th>Role of the students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1 Introduction <em>It aims to stimulate the students to have and interest in learning and to review students’ prior knowledge</em></td>
<td>1. Check the prior experience of students on the content to be learned. 2. Create various contradictory points of views on the content</td>
<td>1. Present their prior experiences. 2. Define the issue which they want to know.</td>
</tr>
<tr>
<td>Step 2 Teaching <em>The objective of this step is to encourage the students to construct their own comprehension and new knowledge.</em></td>
<td>1. Arrange environment to promote learning process for students. 2. Guide students to search and discover the knowledge. 3. Give a guideline for learning new knowledge to students. 4. Help students to be capable to construct their own knowledge 5. Develop learning skills of students. 6. Get the feed-back from students and help them to correct their mis-understanding</td>
<td>1. Try to gain knowledge from real situations. 2. Carry out learning activities and exchange ideas in the group. 3. Search and collect information for self-learning and construct their own knowledge. 4. Practise how to think systematically.</td>
</tr>
<tr>
<td>Step 3 Application of knowledge <em>The aim of this step is to increase the ability of students in using their knowledge.</em></td>
<td>1. Create new situation which students can apply their knowledge. 2. Advise students to solve problems occurred during applying their knowledge. 3. Provide working facilities for students.</td>
<td>1. Analyze the situation. 2. Plan to apply the knowledge. 3. Work according to the plan with high responsibility. 4. Evaluate the outcome of the work. 5. Improve the outcome of the work.</td>
</tr>
<tr>
<td>Step 4 Evaluation <em>This step aims to evaluate the learning outcomes of students</em></td>
<td>1. Create circumstances and environment which promote students to express their experience. 2. Give feedback information on learning to the students. 3. Evaluate the progress in gaining knowledge of students.</td>
<td>1. Present their understanding and the achievement of their learning task and exchange their ideas on the task within a group. 2. Carry out self-evaluation and try to understand ideas of other colleagues in the group.</td>
</tr>
</tbody>
</table>
After designing the instruction model, 7 lesson plans for the learning units were created as follows:

Plan 1: Principle of learner-centered learning
Plan 2: Instruction system
Plan 3: Domains of teaching
Plan 4: Teaching methods and teaching technique
Plan 5: Classroom management
Plan 6: Learner-centered assessment
Plan 7: Designing lesson plans for effective instruction

Step 3. Implementation of the lesson plans as an experiment

In order to implement the lesson plans, they were used to teach 18 students of an education program in the Faculty of Education of NPRU for one semester. These students were assigned to work in groups. Each group comprises 4-6 students.

Step 4. Evaluation of the learning outcomes

The evaluation was based on one group pretest-posttest experimental design [4]. Questionnaires were used as a tool for measuring the students’ knowledge on lesson plan design. The questionnaires are composed of 40 question items, each of which has four choices. In addition, a rubric evaluation form was also used for the evaluating the components of lesson plans produced by the students. These components are input component (students’ prior knowledge and experience, learning objective, and learning materials and resources), component related to process (instruction process and classroom management) and component related to control process (assessment of the learning outcome). Prior to the utilization, the questionnaires were tested with other group of students. The results show that they were reliable within an acceptable level. The rubric evaluation form was also evaluated by three experts and they agreed that the form was suitable for this work. Finally, the improvement of the ability in designing lesson plans of the students was also evaluated by using these questionnaires and the rubric evaluation form. The evaluation was based on the quality of the lesson plans and the improved knowledge for designing the lesson plans of the students.

3. Results and discussion

The results of this investigation are divided into two parts as follows.

1. Knowledge for designing the lesson plans

The knowledge of students for designing the lesson plans before and after the experiment was evaluated by using the questionnaires. The average score and standard deviation (SD) obtained from the questionnaires before and after the experiment are shown in Table 3.

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Total number of the students</th>
<th>Average score $\overline{X}$</th>
<th>Standard deviation (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before the experiment</td>
<td>18</td>
<td>19.8</td>
<td>2.7</td>
</tr>
<tr>
<td>After the experiment</td>
<td>18</td>
<td>23.3</td>
<td>3.2</td>
</tr>
</tbody>
</table>

From Table 3, it is clearly seen that the average score increases from 19.8 to 23.3. In terms of percentage, the score increases by 18.0%. The average score obtained before the experiment is different from that obtained after the experiment, with the significant level of 0.01. This result indicates that the
knowledge on lesson plan design of students is significantly improved after they were taught with the instruction model based on the theories of constructivism and metacognition.

2. Quality of the lesson plans

In this research, the students were assigned to prepare 5 lesson plans. As the first lesson plan was carried out before they were taught by using the instruction model developed in this work, the quality of this lesson plan is considered to be the quality before the experiment. The rest of the lesson plans were carried out during the experiment and their quality was evaluated. The evaluation results are shown in Table 4. The comparison between the average score obtained from the evaluation before the experiment and that obtained after the experiment is shown in Table 5.

Table 4. Quality of the lesson plans prepared by the students after being taught by using the instruction model developed in this work

<table>
<thead>
<tr>
<th>Range of average score</th>
<th>Quality level</th>
<th>Number of students</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.50-3.00</td>
<td>Very good</td>
<td>6</td>
<td>33.3</td>
</tr>
<tr>
<td>2.00-2.49</td>
<td>Good</td>
<td>9</td>
<td>50.5</td>
</tr>
<tr>
<td>1.00-1.99</td>
<td>Fair</td>
<td>3</td>
<td>16.7</td>
</tr>
</tbody>
</table>

Table 5. Average score ($\bar{X}$) and standard deviation (SD) from the questionnaire used to evaluate the knowledge on lesson plan design of the students before and after the experiment

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Number of the students</th>
<th>Average score $\bar{X}$</th>
<th>Standard deviation (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before the experiment</td>
<td>18</td>
<td>1.3194</td>
<td>0.2066</td>
</tr>
<tr>
<td>After the experiment</td>
<td>18</td>
<td>2.3264</td>
<td>0.3036</td>
</tr>
</tbody>
</table>

The results from Table 4 shown that the lesson plans obtained from 50% of the students are in the level “good”. The quality of the lesson plans in the levels “very good” and “moderate” were obtained from 33.3% and 16.7% of the students, respectively. These results indicate that the majority of students can prepare the lesson plans which have a quality in the level “good”.

From Table 5, it is noticed that the quality of the lesson plans produced by students is improved. By using the t-test, the improvement is significant at the level of 0.01. These results of evaluation of the knowledge of students and the quality of the lesson plans produced by the student are significantly improved. This indicates that the instruction model based on the theories of constructivism and metacognition is very efficient and effective. This is due to the fact that, based on the constructivism theory, the students were encouraged to construct the knowledge by themselves whereas the use of the metacognition theory helps the students to control themselves in the learning process. From the instruction model based on these theories, the students were assigned to work in groups. This allows students to exchange their ideas and express their experience, thus enhancing their knowledge. As stated by Vygotsky [5], social interaction is an essential source for constructing the new knowledge. The learning activities used in this work correspond well to this statement. In this work, the students worked in groups with different numbers of the group member, depending on learning activities. With the theory of metacognition, the members of the group can control their learning process. This helps the group to produce a good outcome and achieve the goals. This working method corresponds to the idea proposed by Flavell [6].

In this work the method called PDCA (Plan, Do, Check and Action) was also used to control the working process of students. This method is widely used in industries due to its high effectiveness. It has
also been proven to be effective in improving the instruction in schools [1]. The improvement of the knowledge of the students and the quality of the lesson plans are also resulted from the use of the PDCA method.

4. Conclusions

An instruction model based on the theories of constructivism and metacognition in order to improve their ability in designing the lesson plans has been developed. The model was used to teach 18 students in an education program of NPRU for one semester. It was found that the knowledge in designing the lesson plans of the students and the quality of the lesson plans produced by the students were significantly improved. It is expected that the model can be applied for educational programs in other universities.

Acknowledgements

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References