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An evaluation of activities designed in accordance with the 5E model by would-be science teachers

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Abstract

This study aimed to evaluate activities designed by would-be science teachers in parallel to the 5E Model, based on the constructivist theory. It is a specific-case study from document analysis, and was carried out with 32 students. The would-be teachers were given different subjects from the science and technology curriculum. They then designed activities suitable for the acquisition of the subjects and applicable to the 5E Model, and presented their results in reports. 32 4th-grade students prepared two activities, for a total of 16 activities. The data of the study comprises a quantitative analysis of the activities created by the would-be teachers, which was examined through the criteria and graded. In the analysis, some shortcomings were observed in the would-be teachers’ understanding of the 5E Model, such as in the activity-development process, in transitions between the steps, and in associating the activities with daily life.

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1. Introduction

Since the late 1980s, Biological Sciences Curriculum Study (BSCS) has used one instructional model extensively in the development of new curriculum materials and professional development experiences. That model is commonly referred to as the BSCS 5E Instructional Model, or the 5Es, and consists of the following phases: engagement, exploration, explanation, elaboration, and evaluation. Each phase has a specific function and contributes to the teacher’s coherent instruction, as well as to the learners’ formulation of a better understanding of scientific and technological knowledge, attitudes, and skills (Bybee, 2006). The first phase, Engagement, promotes interest and motivation. Its purpose is to capture children’s imagination. The implementation of this phase is successful if students appear puzzled and are actively motivated to inquire and learn. The second phase, Exploration, is designed to give students common, practical experiences, allowing them to build on their developing concepts and skills. These experiences can be used in subsequent steps to formally introduce scientific conceptions and language. In this phase students are effectively exploring ideas including their ideas. The third phrase, Explanation, gives students the opportunity to explain their findings to others. Students must give their

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explanations first, with the teacher subsequently introducing relevant scientific explanations. These explanations need to be clearly linked to the engagement, exploration activities and student explanations. Essentially, students are provided with a learning environment that encourages them to explain their ideas and understandings. The fourth phase, Elaboration, gives students the opportunity to extend their knowledge of concepts to other contexts. Children have a tendency to associate concepts with specific situations, and are often unable to identify relationships in different circumstances. This phase is vital in developing more general views of phenomena, as children identify similarities in different contexts. Essentially, children apply their new understandings to different contexts in a problem-solving environment. The final phase is Evaluation, in which students’ understandings may be assessed more formally. Students are also encouraged to question their own conceptions. The structure and purpose of the Five Es can be implemented in individual lessons and on a larger scale throughout an entire science and technology unit. Each lesson that is taught using the model can incorporate aspects of a number of phases, and each phase should be evident in the planning and implementation of the unit as a whole (Boddy, Watson, & Aubusson, 2003). The 5E Learning Cycle involves learning something new, or attempting to understand something familiar in greater depth. It is not a linear process. In trying to make sense of things, students use both their prior experience and the first-hand knowledge gained from new Explorations (Newby, 2004).

It is required that these models be applied in the courses which pre-service teachers use, not only in their daily life but also in their professional life, to improve their top level critical thinking skills (Açılış 2010).

Recently, a great number of studies related to the Model 5E based on the Constructivist Theory, which is highly preferred by the Science teachers, where the knowledge is constructed by the person himself/herself can be encountered in the literature. For example, Boddy et al., (2003); Newby, 2004; Wilder and Shuttleworth, 2004; Evans, 2004; Açılış et al., (2009); Açılış, (2010); Altun Yağıc et al., (2010). This study carries a great importance in terms of the fact that it is highly required that the would-be teachers design activities according to the Model 5E and gain a deep insight into the model and make use of the model as the real teachers. In this study, it has been aimed to evaluate the activities which were designed by the would-be science teachers in parallel to the Model 5E based on the constructivist theory.

2. Methodology

This research is a case study that is based on document analysis. The sample of this study consisted of 32 4th-grade students in the first term of the 2010–2011 academic year in the Science Teaching Department, Faculty of Education, Erzincan University. In the study, the would-be teachers were given different subjects available in the curriculum of the science and technology lessons, and were asked to design activities suitable for the acquisition of the subject and applicable according to the Model 5E (based on the constructivist theory). They were also asked to present the results of their studies in reports. All the candidates had taken the course “Special Teaching Methods”. Each would-be teacher prepared 2 activities, for 16 activities in total. The findings of the study were obtained through the evaluation of the activities of the would-be teachers according to the analysis criteria developed by Akdeniz and Akbulut (2010), on a likert-type scale with five categories: irrelevant, bad, enough, good and perfect. Arithmetic averages are reconsidered and labelled as bad from 1.00 to 1.79; low quality from 1.80 to 2.59; enough from 2.60 to 3.39, good from 3.40 to 4.19 and perfect from 4.20 to 5.00.

3. Results

The scores obtained through the activities that were designed by would-be teachers are represented in Table 1.
Table 1. Frequency, percentage and arithmetic averages regarding the grades according to evaluation criteria of the homework.

<table>
<thead>
<tr>
<th>Material Evaluation Criteria</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Entering the topic drawing attention (creating questions and directing for exploring by developing demonstration and question experiment)</td>
<td>f: 0, %: 0</td>
<td>f: 2, %: 12.5</td>
<td>f: 4, %: 25</td>
<td>f: 3, %: 18.75</td>
<td>f: 7, %: 43.75</td>
<td>3,93</td>
</tr>
<tr>
<td>2. Question for discovering students’ misconceptions and pre-information</td>
<td>f: 2, %: 12.5</td>
<td>f: 3, %: 18.75</td>
<td>f: 5, %: 31.25</td>
<td>f: 4, %: 25</td>
<td>f: 2, %: 12.75</td>
<td>3,68</td>
</tr>
<tr>
<td>3. Integration between entering stage and discovering stage (integration of the problem to be discovered and the activities of exploring)</td>
<td>f: 1, %: 6.25</td>
<td>f: 1, %: 6.25</td>
<td>f: 4, %: 25</td>
<td>f: 4, %: 25</td>
<td>f: 6, %: 37.5</td>
<td>3.81</td>
</tr>
<tr>
<td>4. Activities for discovering and configuring of the knowledge (problem solving) by the student</td>
<td>f: 0, %: 0</td>
<td>f: 0, %: 0</td>
<td>f: 0, %: 0</td>
<td>f: 6, %: 37.5</td>
<td>f: 4, %: 25</td>
<td>3.75</td>
</tr>
<tr>
<td>5. Questions and tools for disclosing of the information by the student</td>
<td>f: 1, %: 6.25</td>
<td>f: 0, %: 0</td>
<td>f: 3, %: 18.75</td>
<td>f: 8, %: 50</td>
<td>f: 4, %: 25</td>
<td>3.87</td>
</tr>
<tr>
<td>6. Relationship between exploring and explanation steps</td>
<td>f: 0, %: 0</td>
<td>f: 3, %: 18.75</td>
<td>f: 2, %: 12.5</td>
<td>f: 7, %: 43.75</td>
<td>f: 4, %: 25</td>
<td>3.75</td>
</tr>
<tr>
<td>7. To reveal new situations by applying discovered information to a problem (elimination of incomplete information in deepening step)</td>
<td>f: 2, %: 12.5</td>
<td>f: 1, %: 6.25</td>
<td>f: 1, %: 6.25</td>
<td>f: 5, %: 31.25</td>
<td>f: 7, %: 43.75</td>
<td>3.87</td>
</tr>
<tr>
<td>8. Concept evaluation questions, the project, composition and similar evaluation studies</td>
<td>f: 4, %: 25</td>
<td>f: 6, %: 37.5</td>
<td>f: 3, %: 18.75</td>
<td>f: 1, %: 6.25</td>
<td>f: 2, %: 12.5</td>
<td>2.43</td>
</tr>
<tr>
<td>9. Establishment of the connection to daily life, giving original examples, and emphasizes the importance of the topic</td>
<td>f: 1, %: 6.25</td>
<td>f: 2, %: 12.5</td>
<td>f: 7, %: 43.75</td>
<td>f: 5, %: 31.25</td>
<td>f: 1, %: 6.25</td>
<td>3.18</td>
</tr>
<tr>
<td>10. Emphasis on co-operation</td>
<td>f: 2, %: 12.5</td>
<td>f: 1, %: 6.25</td>
<td>f: 6, %: 37.5</td>
<td>f: 6, %: 37.5</td>
<td>f: 1, %: 6.25</td>
<td>3.18</td>
</tr>
<tr>
<td>11. Activities provide students primary experiences</td>
<td>f: 0, %: 0</td>
<td>f: 3, %: 18.75</td>
<td>f: 5, %: 31.25</td>
<td>f: 8, %: 50</td>
<td>f: 4, %: 25</td>
<td>4.31</td>
</tr>
</tbody>
</table>

It is confirmed that students were been successful after evaluation of the activities about first education science and technology as to 5E education model. It was seem that students are on a lower level about “concept evaluation questions, project and composition works” and they are on a perfect level about development of “activities that will live primary experiments” on examined activities. It was accepted that some activities were enough about to relate with daily life, to give original examples and to emphasis the importance the subject and collaboration. It was confirmed that students were on a high level about “to enter the subject by attracting the attention, accordance between discovering and entering the question steps about concept errors and advance information” and building the knowledge by students. Nonetheless, it was confirmed that students also were on a high level about “questions...
and tools that are relating to explain the knowledge by students; relationship between explaining and discovering steps and displaying new conditions by applying any information to a problem.

4. Discussion

It can be concluded that enough knowledge and experience are performed in Education Faculties and students who are candidates of teaching jobs about understanding of the 5E learning model steps and to apply them to any subjects. It can be said that science teacher candidates are on a high level in their knowledge of contemporary education approaches, use of them, an enough level and to apply them to any subjects that are waited from teachers and teacher candidates. It was said that teacher candidates got the learning model knowledge and techniques from the private education methods lesson about 5E learning model that is one of the contemporary education models of teacher candidates.

5. Conclusion

To apply contemporary education approaches by teacher candidates, these approaches must be found on the field education lessons.

References


