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The investigation of pre-service science teachers’ reflective journals

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Abstract

Higher order cognitive skills have become a crucial aspect and aim of science education all over the world. It is highly crucial that the teachers who teach science hold these skills. The purpose of this study is to determine first-year pre-service science teachers’ levels of reflective thinking and investigate the relationship between their reflection level and academic achievement. The data were collected via weekly reflective journals kept by a group of first-year pre-service science teachers in chemistry laboratory. The participants kept one journal a week for ten weeks. One of the researchers provided weekly feedback for the journals in order to help the participants improve their reflection quality. The journal entries were analyzed through content analysis in order to reveal the general tendency in the participants’ journals. Based on the content analysis seven main themes were emerged: feelings/attitudes, self assessment, learning from activities, preparation for laboratory/prior knowledge, procedure of lab work, group work, opinion about the experiment. Although results showed that the first-year pre-service science teachers’ reflection levels are very low, a positive significant correlation was found between the pre-service teachers’ reflection levels and academic achievement. A longer and more detailed training for keeping reflective journals are suggested to improve reflection skills of the pre-service science teachers.

1. Introduction

Contemporary education system aims to educate individuals who constantly improve themselves by making sense of their experiences in a systematic way. To achieve this aim it is important for individuals to achieve higher order thinking abilities. One of the higher order thinking skills is reflective thinking (Kazu & Demiralp, 2012). Ünver (2003, p.5) defines reflective thinking in terms of education system: “It is thinking process of individual which aims to determine and solve problems regarding positive or negative situations about her/his teaching or learning method and level.” Reflective thinking plays an important role in acquisition of skills such as individual’s awareness of her/his own learning and thinking process, controlling these processes, providing an effective, and creative solutions to the problems (Ersözüli & Kazu, 2011). It is possible to benefit from some strategies to improve reflective thinking, these are: writing for learning, concept mapping, questioning, self-questioning, negotiated learning and self assessment (Wilson & Wing Jan, 1993).

Two-column writing is one of the ways of writing for learning. In two column-writing a page is divided into two columns. On one side of the page students write the information learnt from the activity/experiment and on the other side they record their personal reactions and reflections. Thus, students think about their learning process and realize

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how they learn (Tok, 2008a & Tok, 2008b). Dominguez and McDonald (2009) explained the impact of placing of reflections to learning journals as follows:

If journals consist only of worksheets including data, the goal becomes trying to fill in the blanks rather than practicing inquiry and learning. The addition of reflections in the form of student-generated questions, statements about what has been learned, predictions of outcomes, and comments about successes and failures will help students form meaning from their learning experiences. A separate section of the journal (e.g., the left-hand pages) can be reserved for these reflections. (p. 48)

The related literature that determined students’ levels of reflection (Wong, et al., 1995; Gipe & Richards, 1992; Chalk & Hardbattle, 2007; Sahin, 2009) or that investigated the relationship between students’ reflection level and their academic performance (Chalk & Hardbattle, 2007; Cengiz et. al., 2011) are relatively low in quantity. Published studies in the field, on the other hand, dealt with different research areas. Therefore, there are few studies in pre-service science teacher education in this subject.

The aim of this study is to determine pre-service science teachers’ levels of reflection by examining their reflective journals and investigate the relationship between their levels of reflection and their academic performance.

2. Method

In order to reach the aim, a case study method was used. Thus, we could employ a wide range of techniques simultaneously to further investigate our research problem.

2.1 Participants

The research has been carried out in the General Chemistry Laboratory II with 21 volunteer first-year pre-service science teachers who enrolled the spring semester. The general chemistry laboratory meets once a week for two hours and the participants are required to perform one experiment each week regarding a general chemistry topic.

2.2 Data collection tools

The participants’ achievement and levels of reflection were determined by regular exams and weekly journals respectively.

2.2.1. Reflective journals

The pre-service science teachers were informed about what learning journal is and how to prepare it at the beginning of the semester. They were asked to prepare one learning journal every week after general chemistry laboratory for ten weeks.

In the assignment, the pre-service science teachers were asked to divide a page into two equal parts. On the left half of the page they were asked to write what they had known about the topic before the lesson and what they learnt during and after the lesson. On the right half of the page, the participants were asked to evaluate their own learning with their thoughts and feelings about the learning process. First week of the implementation, there was no chemistry experiments, so pre-service science teachers were asked to reflect on their first laboratory session. They did not require writing a summary (left side of the two-column paper). Pre-service science teachers were given a template which contains some prompt questions and they were told that these questions could guide them during the writing process. Here are the prompt questions: What did you learn?, What do you need to learn?, What do you have to do to learn these?, What did you do to define your deficiencies and improve them?, Could you realize your target?, What did you feel during the learning process? (Before, during and after the experiments), What do you think about the lesson and yourself? The assignment was given back to the pre-service teachers together with their feedback when they handed in the following assignment. (In the following section of the study to be more precise the left side of the assignment will be called the summary and the right side will be called the learning journal).

2.2.3. Course exams as achievement tests

Two exams which are consisted of open ended questions were employed and graded as the determiner of the pre-service teachers’ academic success. One of them was administrated as mid-term exam, and the other as final exam.
The questions were written by the two research assistants who carried out the course in accordance with the experiments made in the lesson. An expert in chemistry education was consulted for validity and reliability concerns.

2.3. Data analysis

Moon (2006) determined reflection levels as descriptive writing, descriptive account with some reflection, reflective writing 1 and reflective writing 2. In order to determine the pre-service science teachers’ level of reflection, each learning journal had been tried to be examined and graded from 1 to 4 based on Moon’s (2006) rubric. But, it was soon realized that it is difficult to fit some of the journals into these categories, so we developed intermediate levels to describe the levels of reflection. One of the researchers analyzed all journals. After six months of the first set of analysis, the researcher reanalyzed 35 of the journals. The correlation coefficient between the two ratings was calculated as 0.74. The reflection level of each pre-service science teacher was calculated by taking average score of all of their own journals. Correlation between achievement and reflection level was calculated via computer software. The data collected from the journals were also subjected to content analysis to determine what the participants mention in their journals.

3. Findings and discussion

The findings are presented two main headings: In first part, reflection level of the pre-service teachers has been determined and the relationship between their academic performance and reflection level has been examined and discussed. In the second part, issues, topics and subjects that pre-service science teachers’ dealt in their journals are presented.

3.1. The relationship between the academic performance and the level of reflection

As seen in Table 1, the average reflection level ranges between the values 1 and 1.94. These values indicate that the reflection levels of the pre-service science teachers are within the value range determined by Moon (2006) for “descriptive writing (1)” and “descriptive writing with some reflection (2)”. Some studies which were conducted on pre-service teachers reported low level of reflection similar to our results (Şahin, 2009; Cengiz, et.al. 2011).

Even though, the participants’ level of reflection is low, there is a slight positive correlation between achievement in chemistry laboratory and reflection level (r=0.474). This finding demonstrated that higher reflection level would be the indicator of higher grades in the course. As Kim (2005) stated that reflective thinking might be better achievers in school setting.

Table 1. The correlation between academic performance and the level of reflection

<table>
<thead>
<tr>
<th>Student /Ass.num.</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
<th>Reflection Level</th>
<th>Average exam scores</th>
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</thead>
<tbody>
<tr>
<td>Sema</td>
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<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
<td></td>
<td>1.61</td>
<td>73.5</td>
</tr>
<tr>
<td>İlke</td>
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<td>1</td>
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<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>46</td>
</tr>
<tr>
<td>Cansu</td>
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<td>1</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>1</td>
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</tr>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
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<td>1.5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>2.5</td>
<td></td>
<td></td>
<td>1.5</td>
<td>73.5</td>
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<td>1.5</td>
<td>1.5</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1.38</td>
<td>73</td>
</tr>
<tr>
<td>Ayşe</td>
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<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td>1.1</td>
<td>59</td>
</tr>
<tr>
<td>Nilay</td>
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<td>2</td>
<td>1.5</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1.5</td>
<td></td>
<td>1.65</td>
<td>63</td>
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<td>1</td>
<td>2</td>
<td>2</td>
<td>2.5</td>
<td></td>
<td>1.72</td>
<td>55</td>
</tr>
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</table>
3.2. Content of the journals

As stated in methods section, pre-service science teachers were given some prompt questions. It was clearly stated that they do not need to answer these questions one by one. The main purpose of providing these questions was to allow pre-service teachers to answer one or more questions by thinking deeply. Despite of this warning, most of the pre-service science teachers tried to respond almost all questions superficially. According to Moon (2006), trying to pay attention everything in class in journals, is one of the characteristics of descriptive writing. Therefore, most of the examined journals are not reflective. However, in some cases, the pre-service science teachers were found to focus on a particular subject.

As seen in Table 2, seven themes were emerged from the content analysis of the journals, including; feeling/attitude; self assessment; learning from activities; preparation for laboratory/prior knowledge; procedure of lab work, group work, opinion about the experiment.

Table 2. Content of reflective journals

<table>
<thead>
<tr>
<th>Theme</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feelings/Attitudes</td>
<td>71</td>
</tr>
<tr>
<td>Self assessment</td>
<td>68</td>
</tr>
<tr>
<td>Learning from activities</td>
<td>68</td>
</tr>
<tr>
<td>Preparation for laboratory/prior knowledge</td>
<td>49</td>
</tr>
<tr>
<td>Procedure of lab work</td>
<td>47</td>
</tr>
<tr>
<td>Group work</td>
<td>24</td>
</tr>
<tr>
<td>Opinion about the experiment</td>
<td>18</td>
</tr>
</tbody>
</table>

Lew and Schmidt (2011) aimed to evaluate whether there is evidence of reflection in student-written journals and they studied with 3460 first year students enrolled in a polytechnic. Outcomes of the content analyses suggest that students reflected on three general categories related to their learning: critical review of past experience, cognitive learning strategies and summaries of what was learnt.

Pre-service teachers’ statements under these themes are examined separately. Accordingly under 4 themes (including such as feelings/attitudes, self assessment, preparation for laboratory/prior knowledge, group working) it is possible to see in limited number of the writings, some reflections which are not deep. Under learning from activities, procedure of lab work, opinion about the experiment themes, definitely descriptive statements were used. The themes which reflection occurred are mentioned below.
Feelings/Attitudes

71 out of 133 journals have been found references to feelings/attitudes. Under this theme pre-service teachers expressed their feelings during the laboratory sessions. Especially they mentioned their feelings like excitement, curiosity, fear and anger. Also it is possible to get information about pre-service teachers’ attitudes to learning environment. Pre-service teachers generally used descriptive statements. “The experiment was so fun” (Seçil), “I did this experiment very fondly” (Ela), can be given as an example for these descriptive statements. At the same time in some statements the reason for the feeling was also expressed: “It scared me a little because it is about operations. During the experiment I was afraid of failure” (Mehtap). “Performing the experiments and being so close to some of the materials and elements which we had heard for years is very nice. I liked conducting the experiment, touching and holding everything at my hand. (Nilay)” When these examples compared to the initial examples, it is clear that the later ones are more reflective. Regardless, we can generally say that the pre-service science teachers described their feelings; they did not express the effect of their feelings into their behaviors.

Self assessment

68 out of 133 journals included self assessment of the participants. The journals which addressed self assessment argued what they have and have not learned, the factors that affect their learning, and/or reasons for their failure. Besides, there are a few pre-service teachers who assessed themselves in other subjects (for example in communication skills). Under this theme the most repeated general expression is “I understand the experiment”. It is difficult to accept this expression as reflective if not displayed on a basis. Sometimes it is possible to learn from the reflective journals or the summary part of the assignment that pre-service teacher corrected, misunderstood or ill-constructed conceptions which are related to the course content. Besides, few journals contained analysis of what they know and they do not. It can be said that these writings are more reflective: “At the end of the course, I think I completed my deficiencies about solution or solubility, I don’t think that I will have problems in exams, in the future. But, I have problems about bonding. Before exams, I have to solve this and understand the concepts…” (Yılmaz). Another example which contains some reflection is: “Although I knew the subject, I recognized that I couldn’t do. This made me sad because it is one of the favorite courses that I am taking. The reason for not being able to explain and express the subjects/concepts which I know is to not believe in myself because I do not believe I know enough.” (Nilay). As can be understood this pre-service science teacher forming a discourse with herself. She stated the reasons of her failure, but inconsistencies in her expression are recognizable.

Preparation for laboratory/prior knowledge

49 out of 133 writings collected under this category. Pre-service teachers mentioned what they do and know before performing the experiment in the laboratory. The following quote would represent the general idea of this theme: “Before the lab, I read lab text and I answered the questions about the experiment.” It can easily be deducted from the quote that the pre-service science teachers’ journal notes are mostly descriptive. However, there are rare incidences that contain traces of reflection: “Being ready for the experiment gave me self confidence during the lab. Thus, I don’t stand behind and I wasn’t shy to respond to the lecturer’s questions. So, time flies fast as if it was two minutes rather than two hours (Ayça).

Group work

Almost one fifth of the journals addressed group work which includes receiving support from the group members; not becoming a prominent member of the group; performance of the group members; and getting along with the group members. Most of these journals depict what they have done in the group or how well they get along with each other: “We have a good compliance among our group members”. There are few more reflective ones: “I understand the importance of working in a group well after this lab because when we are a few we take more responsibility so we learn well. But, when there are many people around, there would be a lot of ideas to suggest. Thus, I have chance to choose an idea among them. I think that both cases have advantages and disadvantages…” (Yılmaz).

It can be derived from the journals that pre-service science teachers’ expressions did not involve how to apply new knowledge to different settings. It would also be said that the pre-service science teachers seem not to think the ways of how to learn well or how to study more efficiently. One reason for this may be the inadequacy of the training about how to keep a reflective journal or the prompt questions that were provided after every journal. Zeki (2012) asked pre-service teachers to write reflective journals after practice teaching course regularly and then she
investigated the pre-service teachers’ opinions about writing reflective journals. The results showed that pre-service teachers reported that the guiding questions were lack of depth, diversity, and perspective.

4. Conclusion

The main purpose of the present study was to determine pre-service science teachers’ levels of reflection and the relationship between their reflection level and academic performance. The results showed that most of the pre-service teachers reflection level was categorized as descriptive or descriptive account with some reflection which determined by Moon (2006). Pre-service science teachers’ reflective expressions were collected in feeling/attitude, self assessment, preparation for laboratory/prior knowledge, group work, procedure of lab work, opinion about the experiment themes. Before the implementation pre-service teachers were given some prompt questions and these questions guided them during the writing process. The low level reflection skills of pre-service teachers’ was thought to be effective adding different prompt questions that enable pre-service teachers to reflect upon their thoughts.

We found that there is a slight positive correlation between the pre-service science teachers’ reflection level and their General Chemistry Laboratory exam scores. Even though, this study is not inferential, the findings might support the claim that reflective thinking is important for academic performance. However, because the pre-service teachers’ reflection levels were found descriptive, further and more detailed research similar to current study should be conducted to determine the relationship between reflection level and academic performance well.

References


