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ANALYSIS OF PRE-SERVICE SCIENCE TEACHERS' VIEWS ABOUT THE METHODS WHICH DEVELOP REFLECTIVE THINKING

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ABSTRACT

In this study, we investigate of science and technology pre-service teachers' opinions about the methods developed reflective thinking and we determined at the level of reflective thinking. This study is a descriptive study. Open-ended questions were used to determine the views of pre-service teachers. Questions used in the statistical analysis of data for obtained student's through. Solution to the problems encountered in practice as a method for the production of research so descriptive research approaches used in the survey method. This study was applied Department of Science Teaching at the Faculty of Education students in the third class. Department of ScienceTeaching 32 students participated the study in Bayburt University. The 32 students in the sample and all of the mare 18 female and 14 male. The findings of the study about students opinion for reflective thinking skills that most of the prospective science teachers' technical reflective thinking skills were beter than critical reflective thinking skills. In the area of critical reflective thinking skills is not at all note worthy. In addition, pre-service teachers have expressed their positive contributions to the teaching skills of the methods developed for reflective thinking. Work towards the development of preservice teachers' reflective thinking skills are complemented by recommendations.

Key Words: The methods developed reflective thinking, Descriptive reflective thinking, Critical reflective thinking, Pre-service science teachers.

INTRODUCTION

Education is the most important component of economic and social development in our day and it is in the state of rapid and continuous change throughout the world. Today's information society demands for individuals who have thinking skills, can think critically, demonstrate different methods while solving problems, are sharing, and can materialize the knowledge they have gained (Köksal and Demirel, 2008). In line with this condition, pre-service teachers take a lot of theoretical and applied courses related to content knowledge, general knowledge and professional knowledge (Kılınç, 2010). The new science curriculum has adopted an approach based on research and inquiry and it is quite important that reflective thinking which is a sort of cognitive driving force of this approach should be promoted within the pre-service teachers so that teacher can adopt it (Gencer, 2008; Kılınç, 2010; Töman and Çimer, 2014).

Reflective journals are very important to foster reflective thinking. Journals are the materials in which students record their own personal reactions, questions, feelings, changing ideas, thoughts, learning processes, and the knowledge related to their learning content (Ünver, 2003). Students do not simply discuss their experiences

during the learning process in reflective journals. These writings include the explanations, analysis, and reflections which students make about their learning (Ünver, 2003). In other words, they are written in a certain system, plan and program. Moreover, journals are effective for students to actively engage in a course or any learning activity. An important effect of reflective journals is that teachers can get feedback about the curriculum which they implement from the students' reflective writings. Therefore, teachers can design more suitable teaching and learning activities for the students. Teachers can also write about the curriculum which they implement and their teaching behaviours. These pieces of writings can give them opportunities to evaluate the curricula they have implemented, teaching approaches, and themselves. Teachers can also benefit from these writings to create a better class environment and to develop themselves (Rodgers, 2002; Ünver, 2003).

According to Wilson and Jan (1993), reflective thinking is a self-evaluation process. It is stated that these evaluations can serve for individual's self-concept, experiences and learning. Such questions as which topic did I choose? (adaptation process), what do I need first to complete the topic ? , what are my resources? (identifying the needs), how did my ideas change? What can I do in the next stages?, did I understand the topic? can be asked in this approach which enables a student to communicate, plan, organize and reflect his own learning (Dolapçıoğlu, 2007). Self-evaluation includes students in the teaching process during the evaluation process. Self-evaluation encourages reflective thinking in students. It enables them to take more responsibility for their learning. Students who can evaluate themselves can create goals and they can follow how they achieved these goals. In addition, they can evaluate the results they have obtained and generate new ways of solutions after discovering their weaknesses (Ersözlü, 2008).

Microteaching studies intended for the pre-service teachers can also develop reflective thinking (Gencer, 2008; Kılınç, 2010). Microteaching is intended to help pre-service teachers acquire experiences regarding teaching experiences before they practice them in real education environments. In microteaching practices, the teacher candidates criticise themselves and each other and they participate in the reflection process (Ünver, 2003). In such kind of activities, video cameras are used and thanks to videotaping, the pre-service teachers view themselves and their teaching skills, so they can make contributions to enhance their reflective thinking. In addition to this, the instructor examines the lesson plans prepared for the short lesson and gives positive or negative feedback which are quite effective on reflective thinking (Alp and Taşkın, 2007; Ünver, 2003).

The teachers' and pre-service teachers' levels of reflective thinking, their development, and reflective thinking dimensions have been a new field of study in our country in recent years. Although the skill of "training teachers who can think reflectively" is included in teacher training programs in theoretical terms, lack of theory and implementations regarding this skill in education faculties necessitate studies related to reflective thinking(Alp and Taşkın, 2007; Dolapçıoğlu, 2007; Töman and Çimer, 2014; Yorulmaz; 2006). It is considered that this study ,which aims at examining the pre-service science teachers' views regarding the methods which develop reflective thinking skills in the "Special Teaching Methods I" course, will lead other research studies in this field.

Purpose

The aim of this study is to examine the pre-service science teachers' views about the methods which develop reflective thinking skills considering the reflective thinking aspect.

METHOD

The study which is carried out to examine the pre-service science teachers' views about the methods which develop reflective thinking skills considering the reflective thinking aspect is a descriptive research. Open-ended questions were used to determine the views of the pre-service teachers. The statistical analysis of the data obtained via questions was utilized. Thus, survey model, one of the descriptive research methods, was chosen to investigate the situations which were encountered during the implementation and to generate solutions. Survey models are the arrangements of the scan carried out on all of the universe or a group of sample taken from it or carried on samples in a universe composed of many elements with the aim of passing a

general judgment (Yıldırım and Şimşek, 2011). Generalisations are tried to be achieved through the statistical analysis of the data obtained with questions. After a complete picture of the case which is studied is obtained, case studies can be started after taking a very special sample from this picture (Çepni, 2012).

The Sampling Method

The research was carried out with the third year students studying in Science Teaching Department of Education Faculty in Bayburt University. Thirty-two students from Science Teaching Department at Bayburt University participated in the study. Out of 32 students, 18 of them are females and 14 of them are males. This study was carried out within the framework of "Special Teaching Methods I" course taken by the students in the spring term. Each pre-service teacher individually made 20-25 minute presentations. Each pre-service teacher prepared a lesson plan for the presentations. In addition, microteaching was carried out with the per-service teachers about their practices and following the microteaching, teacher candidates filled in self-evaluation forms and reflective journals. Furthermore, they participated in the meetings regarding the methods which enhance reflective thinking.

Data Collection Tools

Four open-ended questions which were designed to examine the pre-service science teachers' views about the methods which develop reflective thinking were used as a data collection tool. Moreover, observations which the researcher did during the implementations were utilized. The open-ended questions were evaluated by taking the views of an expert with regard to content, language, and clarity and intelligibility. Necessary corrections were made in line with the expert opinions and the questions were finalized. Semi-structured interview was used in this research and the interviews were carried out individually. The interviews were carried out with 32 pre-service science teachers, who were identified as special case, and according to the criteria determined by the researcher. Each interviews lasted 20-25 minutes. Some abbreviations were used while presenting the findings obtained from the interview data. The abbreviations were given as follows. For example, IPST-1 represents "the first student among the pre-service teachers with whom the interviews were carried out".
R: Researcher (Interviewer),: I (Interview), PST: Pre-service science teacher
1: First Student , 2: Second Student , 3: Third Student , 4: Fourth student , 5: Fifth Student

Data Analysis

The data obtained from the interviews carried out with the pre-service science and technology course teachers was analyzed via content analysis technique. The data which are similar to each other are gathered within the framework of certain concepts and themes; they are organized clearly, and interpreted (Yıldırım and Şimşek, 2011). In line with this technique, the data were classified and evaluated. The data obtained from the responses of the teachers to the open-ended questions were analysed in the research. The data were analysed and their frequencies (f) and percentages (%) were given. Out of the teacher responses to the questions, quotes were also used.

In addition to these, when the research questions were identified, the research studies carried out by Dolapçıoğlu (2007), Ekiz (2006), Yorulmaz (2006) and Şahin (2009) were utilized. It was considered that the reliability of the questions used in the relevant literature was provided. Moreover, the reliability of the questions was provided with the expert opinions and the relevant literature. In the next section of the study, the findings obtained from the analysis were presented widely.

FINDINGS AND DISCUSSION

The findings obtained from the analysis of the responses given to the four open-ended questions which were designed to examine the pre-service science teachers' views about the methods which develop reflective thinking skills considering the reflective thinking aspect were presented below.

Table 1: The findings obtained from the Interviews of Pre-service Science Teachers about the Methods which Develop Reflective Thinking

Methods Which Develop Reflective Thinking	Questions Asked in the Interviews	Categories	Levels of Reflection					
			Reflections in Technical Field		Reflections in the Implementation Field		Reflections in the Critical Field	
			f	%	*f*	%	*f*	%
Micro teaching	What do you think about the microteaching carried out during the implementation process? Do you think that it is effective in your learning? Why?	-An implementation that is carried out for the first time -Its contribution to teaching skills	22	69	10	31	0	0
Lesson plan	What do you think about the lesson plan which you prepared during the process? Do you think that it is effective in your learning? Why?	-Its contribution to teaching practices - Its contribution to teaching skills -Its contribution to teaching the lesson -An implementation that is carried out for the first time	22	69	10	31	0	0
Self Evaluation	What kind of effect did self-evaluation have on your learning? Why?	- Its contribution to teaching skills -An implementation that is carried out for the first time	24	75	8	25	0	0
Reflective Journals	What do you think about the reflective journals which are kept during the implementation process? Do you think that they are effective in your learning? Why?	- Its contribution to teaching skills -An implementation that is carried out for the first time	26	81	6	19	0	0

As it is viewed in Table 1, when the findings obtained from the interviews of pre-service teachers about the methods which develop reflective thinking, the pre-service teachers mostly (69%) answered the question which was about the microteaching implementations in the process as reflections in the technical field. The pre-service teachers who developed reflections in the technical field mostly used simple and plain expressions about microteaching implementations. The levels of reflection with the pre-service teachers were mostly observed in the technical field and the reason for this is that they only focused on the necessary principles to reach the goals which were specified (Langer, 2002; Tang 2000). Similar conditions were identified in the study conducted by Şahin (2009). All of the pre-service teachers stated that they did not do any practices which fostered reflective thinking before. Moreover, all the pre-service teachers stated that these methods which develop reflective thinking would specifically make contributions to the development of their teaching skills. The response of a pre-service science teacher can be given as an example to this condition:
R: What do you think about the microteaching carried out during the implementation process?
RIPST-20: I believe that microteaching has benefits.
R: Why is it beneficial?
IPST-20: Normally you just explain it. But when you watch yourself after the teaching process you realize your weaknesses.
R: Have you ever experienced microteaching implementations in your previous education process? How?
IPST-20: We have never done such educational implementations before.
R: What do you think about such implementations which are intended for reflective thinking? IPST -20: To me, these methods are quite good. This is our first experience. It will be better next time. I believe it was quite good.

As it is seen in table 1, it was understood from the responses of the pre-service teachers given in the interviews about the microteaching which is carried out to develop reflective thinking that the level of reflection in the implementation level (31%) was lower than the level of reflection in the technical field. The pre-service teachers who developed reflections in the field of implementation made comments depending on their individual perceptions regarding implementation of microteaching and reflective thinking. Similar conditions were also discovered in the literature (Tok, 2008; Yorulmaz, 2006). The response of a pre-service science teacher can be given as an example to this condition:
R: What you think about micro teaching which is carried out during the implementation process? Do you think that it is effective in your learning?
IPST -11: Of course, micro teaching has benefits.
R: Why is it beneficial?
IPST -11: When you are at the board, you sometimes don't see what you are doing. You say that I'm good because the students participate in the lesson and I'm teaching the subject. However, when we watched the video, I said that if I had walked around the classroom, I would have controlled the class better. If I had given students more opportunity to talk, the students would have participated in the lesson more actively and I would have the whole class get involved in the course. Therefore, I realized my weaknesses.
R: Have you ever experienced microteaching implementations in your previous education process? How?
IPST -11: We have only done presentations before. We have never carried out such practises intended for reflection before.
R: What do you think about such implementations regarding reflective thinking?
IPST -11: In my opinion, if you had intervened in every step, such a negative thing would have occurred: I would be demoralized and discouraged if you had told me to stop or that it would be better if you did it like that while I was teaching and due to demoralization, I would not transfer the information as I wished. Moreover, I, myself, identified my learning objectives and prepared my materials. If you had set them, I would have practised them as you wanted and I would have had difficulties. Because I set my learning objectives, I thought that if I carried out this implementation, I would have my students gain them. I think it was really good for us to actualize the implementation.

Moreover, as it is represented in Table 1, the most remarkable point is that none of the pre-service teachers had reflections regarding critical field concerning the implementations of microteaching and reflective thinking.

When the findings obtained from the interviews of pre-service teachers about the methods which develop reflective thinking, it was determined that the pre-service teachers mostly (69%) had levels of reflection in the technical field concerning the lesson plans which they prepared according to their practices. The pre-service teachers who developed reflections in the technical field stated that the points which they focused on were only what they saw, experienced and felt. Taggart and Wilson (2005) attribute this to the fact that inexperienced (novice) pre-service teachers lacked experiences regarding the methods which foster reflective thinking. Similar conditions were identified in the study carried out by Dolapçıoğlu (2007). The pre-service teachers mostly focused on the implementation of the lesson plan and its contributions to their teaching skills in their statements about lesson plan. All of the pre-service teachers stated that they had not prepared a lesson plan before and they mentioned the positive contributions of the lesson plan to their teaching. The response of a pre-service science teacher can exemplify this condition:
R: What do you think about the lesson plan which you prepared during the implementation process? Do you think that it had an effect on your learning?
IPST -7: The lesson plan certainly made contributions to me.
R: Why did it make contributions?
IPST -7: It was my road map. Anything did not happen by sticking to something. All of them followed each other and the results were better.
R: Have you ever prepared a lesson plan in your previous education process? How?
IPST -7: No, I haven't. It is the first time in this course we have done something like this. Before this implementation, we prepared slides, we were at the board, told them, and then sat at our desks. This is our first experience except this one.
A: What do you think about such implementations regarding reflective thinking?
IPST -7: It was more effective to introduce our opinions. If you had intervened about this subject, we would not have been able to express our opinions; we would have reflected your opinions.

As it is presented in Table 1, it is understood from the responses of the pre-service teachers given in the interviews that the level of reflection in the implementation level (31%) was lower than the level of reflection in the technical field. The pre-service teachers who developed reflections in this field not only stated the contributions the lesson plan made to their implementations and teaching skills at a simple level but also they made comments depending on their subjective perceptions. Similar conditions were also discovered in the literature (Yorulmaz, 2006). The responses of a pre-service science teacher can be given as an example to this condition:
R: What do you think about the lesson plan which you prepared during the implementation process? Do you think that it is effective in your learning?
IPST -29: I had a little difficulty when I first made the lesson plan, but when I took it from my friend, it was blank. In other words, changing an existing one is taking the easy way out. I was in trouble while preparing it, but I asked to the students in upper grades. In other words, I learned how to prepare a lesson plan. At least I learned how to overcome the weaknesses and how to explain the topic.
R: What are the benefits of a lesson plan?
IPST -29: You learn new methods. They are the methods which you know but you learn how to apply them. It was good in that way. Because it was the first time I used them, it was quite different and fun.
R: Have you ever prepared a lesson plan in your education life before? How?
IPST -29: No, I haven't. But we did something like that. Suppose that a topic is going to be taught in history. We prepared our slides and explained it. It was not an assessment or evaluation. We got only extra points from it and it was added on our final grade. We do not know its results.
R: What do you think about these implementations regarding reflective thinking?
IPST -29: This one was really better. I mean that you shared with us your theoretical knowledge. We do our homework with the help of this knowledge; as a result we have to consider it as an assignment. But also we have to feel that it is our first professional day. Of course, we will have weaknesses. You let us go and it is really great. That is to say, you do not interfere, just sit at the back. Thus, when I am at the board, I feel independent.
Moreover, as it is seen in Table 1, it is found that reflection regarding the lesson plans in the critical field was not identified by any of the teachers.

When the responses of the pre-service teachers to the question about self-evaluation, one of the methods which develop reflective thinking, in the interview were considered, it was determined that the pre-service teachers mostly (75%) had levels of reflection in the technical field. When the responses related to the level of reflection in the technical field were examined, it was revealed that the pre-service teachers mentioned the positive contributions self- evaluation made to their teaching skills at descriptive and simple levels. Similar results were obtained in the study conducted by Ekiz (2006). In addition, all of the pre-service teachers stated that they hadn't carried out any practices regarding self-evaluation. The response of a teacher was given below to exemplify this condition.
R: How did self-evaluation affect your learning during the implementation process?
IPST -23: Self-evaluation was so useful.
R: Why do you think it was so useful?
IPST-23: I saw the difficulties and constraints encountered during the implementation in self-evaluation form. I began to notice the things which I had not noticed during the implementations. It made me view myself and make comments.
R: Have you ever performed self-evaluation practices in your previous education life? How?
IPST -23: We have never practised such implementations of reflective thinking. We only explained the topic.
R: What do you think about such implementations regarding reflective thinking?
IPST -23: I evaluated myself; I realized my weaknesseses and mistakes. I will never do them again.

As it is seen in Table 1, it is understood from the responses of the pre-service teachers about self-evaluation in the interview that their levels of reflection in the implementation field (25%) was lower than their levels of reflection in the technical field. The pre-service teachers who developed reflection in the implementation field did not mention the positive contributions of self-evaluation to their teaching skills at a simple level. Moreover, they interpreted the positive contributions of self-evaluation with its reasons. Similar cases also occur in literature (Töman and Çimer, 2014). The response of a teacher was given below to exemplify this condition.
R: How did self-evaluation affect your learning during the implementation process?
IPST -14: Of course, self evaluation has benefits.
R: Why is it useful?
IPST -14: When a person is at the board, he does not realize or see what he is doing. You say that I am good, but when you watch yourself and self-evaluate, you realize that it is not so. The questions in the self-evaluation form are very important because they give us a chance to review what we have done during the implementation. Therefore, you say that I won't make these mistakes next time. For example, if I did the same practice again, I would stick to the same format, but different form this, I would choose experiment designs from daily life For example, I would do experiments and use materials which students would identify as light and sound when they saw them.
R: Have you ever performed self-evaluation practices in your previous education before? How?
IPST -14: In line with such a plan, we have not had any applications of self-evaluation. So, with this implementation, we had an opportunity to evaluate ourselves both in terms of materials and methods we used. It was very effective. We not only turn on the slides and read them but also we use our teaching skills and evaluate these skills later.
R: What do you think about such implementations regarding reflective thinking?
IPST -14: We have never performed such implementations before. We only brought the slides to the classroom and explained them. But now this practice is really better. The students in the class learned a lot of things. When we become a teacher in the future, new ideas will begin to emerge in our minds about the topic we are going to teach and the methods we are going to use.

As it is seen in Table 1, it is found that reflection regarding self-evaluation method in the critical field was not identified with any of the teachers.

When the findings obtained from the interviews of pre-service teachers about the methods which develop reflective thinking, it was determined that the pre-service teachers mostly (81%) had levels of reflection in the technical field concerning the reflective journals which they prepared according to their practices. The pre-service teachers who developed reflections in the technical field used simpler and plainer expressions

regarding reflective journals. Gencer (2008) and Kılınç (2010) determined similar situations in their research studies. All of the pre-service teachers stated that they did not keep reflective journals before. Moreover, all the pre-service teachers pointed out that reflective journals would make contributions to promote their teaching skills. The response of a teacher was given below to exemplify this condition.
R: What do you think about the reflective journals which are kept during the implementation process? Do you think that they are effective in your learning?
IPST -30: In my opinion, they are very helpful.
R: Why do you think they are very helpful?
IPST -30: The journals I wrote had benefits. I read them and saw my mistakes. I tried not to make these mistakes again. I revised them. I look at what I did better or what I can do better. It was fine.
R: Have you ever used reflective journals in your previous education before? How?
IPST -30: We have never used them before. Before the journals, we used to explain from the slides. I think they will be helpful in the practical training next year.
R: What do you think about such implementations regarding reflective thinking?
IPST -30: Journals have benefits. You evaluate yourself. You realize your weaknesses and strengths and you are more careful next time.

As it is seen in Table 1, it is understood from the responses of the pre-service teachers about reflective journals which they kept to foster reflective thinking in the interviews that their levels of reflection in the implementation field (19%) was lower than their levels of reflection in the technical field. The pre-service teachers who developed reflections in the implementation field made comments depending on their individual perceptions. Similar cases occur in literature (Alp ve Taşkın, 2008; Erginel, 2006). The response of a teacher was given below to exemplify this condition.
R: What do you think about the reflective journals which are kept during the implementation process? Do you think that they are effective in your learning?
IPST -22: Of course, they are effective.
R: Why do you think they are effective?
IPST -22: I wanted to write my diary as soon as I went home because I wanted to reflect my weaknesses or strengths with my new-found knowledge. Keeping journals helped me think what I did. Therefore, I believe that journals are useful. You write what you think; you look at it and say that I made a mistake here. When I have my journal with me and I review it, I will remember my weaknesses. For example, during my implementation, I had a trouble of managing the class. The questions in the journal reminded me this problem and it made me think about its reasons. Moreover, it helped me to consider alternative ways of solutions. That's why it was so effective.
R: What do you think about such implementations regarding reflective thinking?
IPST -22: To me, this is better. If we are appointed, we will explain these topics in the class. It was much better because we determined the whole process and you used methods which encouraged us to consider out implementations.
R: In what ways it was good?
IPST -22: We identify the topic and the activity and we think about our weaknesses. If you had told us the learning objectives and which method to use, we would have practised them. However, we considered which one would be better and efficient to teach and we made a decision

RESULTS

Considering the findings obtained from the research, it was revealed from the most of the statements of the pre-service teachers in the interviews that their levels of reflection in the technical filed were in the forefront. The pre-service teachers presented the situations they encountered for the methods which develop reflective thinking. In addition to this, it was found that there was lack of statements concerning the technical field in the interviews of pre-service teachers. Thus, it was concluded that the pre-service teachers could not adequately reveal their skills of reflection in technical field during the interviews.

Although most of the pre-service teachers expressed statements regarding reflections in technical field, there were not statements regarding reflections in critical field. The pre-service teachers could not entirely demonstrate their skills of reflection in critical field. It was determined that the pre-service teachers who used expressions which could be counted as reflections could not use their skills of reflection in implementation field and technical field together. Most of the teachers asserted that such practices as lesson plan, self-evaluation, reflective journals, and micro teaching made contributions to their teaching skills. Moreover, it was concluded that the pre-service teachers carried out the implementations which develop reflective thinking for the first time in their life. While the pre-service teachers made explanations about the methods which promote reflective thinking, they simply and clearly described what they experienced. However, the pre-service teachers could not consider the situations they described critically. They introduced their implementations in superficial ways.

Regarding the results obtained from the research study, pre-service teachers must be given theoretical training in the courses regarding development of teaching skills on reflective thinking, kinds of reflective thinking and importance of reflective thinking. In line with this, in practical training course, while they are writing journals for each training day for their teaching file, they may be asked to keep these journals in a way to exhibit their reflective thinking skills. Pre-service teachers can be directly given the criterion which they are going to take into account when they are filling in a self-evaluation form, keeping journals, and preparing a lesson or this criterion can be determined with them.

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