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The effect of portfolio use on the development of critical thinking strategies of pre-service teachers with different learning approaches

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ABSTRACT

The aim of the study is to explain the effect of portfolio use on the development of critical thinking strategies of pre-service teachers with different learning approaches. The study used a case study design. The sample consisted of 26 pre-service biology teachers. The Study Process Questionnaire developed by Biggs was used to determine the learning approaches of pre-service teachers. Data were collected through interviews and portfolios. The data obtained were analyzed by descriptive analysis method. Through the use of portfolios, it was found that pre-service teachers improved in questioning what they learned, using time and finding solutions. It was also found that critical thinking skills of pre-service teachers with surface learning approach were at a lowerlevel. It was determined that pre-service teachers with strategic and deep learning approaches differed from pre-service teachers with surface learning approach in terms of establishing relationships between the subjects they learned. The skills of finding a solutionto the problem encountered, which is one of the critical thinking skills of pre-service teachers with deep and strategic learning approach, was developed through the portfolio. It is recommended that teachers should develop instructions and activities suitable for each learning approach by considering learning approaches in developing critical thinking.

Keywords: Pre-service biology teacher, critical thinking, learning approach, portfolio.

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INTRODUCTION

Changes in accessing and using information throughout the world over time have been reflected in education systems in different ways. The constructivist learning approach has taken its place in the Turkish Education System with the program change made throughout the country in 2005-2006. The vision of "raising happy citizens of the Republic of Turkey who have adopted Atatürk's principles and reforms, who are equipped with basic democratic values, who have developed research-inquiry, critical thinking, problem-solving and decision-making skills regardless of their individual differences, who are lifelong learners and respectful to their people" has been adopted (Ministry of National Education, 2005). In this direction, it is aimed to raise individuals who are learner-centered, self-determining learners instead of passive and non-participatory students who receive information directly. In other words, this learning theory expects students to take responsibility for their own learning and to know what, when, how and in what order they will learn. Therefore, in anongoing process under the control of the learner, the learner uses his/her knowledge to solve allkinds of life problems (Aydın and Demir, 2014; Brooks and Brooks, 1999). The development and acquisition of critical thinking skills, which are among the 21st-century skills accepted in

our country's education system and the world, is important in raising individuals who can keep up with age.

Critical thinking is the learner's use of existing knowledge in solving problems in new situations, making decisions, and making critical comments according to established standards(Pintrich et al., 1991). Ennis (1985) defined critical thinking as logical and reflective thinking focused on deciding what to do and what to believe. Demirel (1999) stated that critical thinking is based on the ability and tendency to acquire, evaluate and use information effectively. Demirel (1999) identified five basic dimensions of critical thinking: coherence, integration, applicability, competence and communication'. Coherence is related to the ability of critical-thinking individuals to recognize the contradictions they have and to eliminate these contradictions. In the dimension of unification, it means that the individual can establish a relationship between the thoughts he/she has. In the dimension of applicability, the individual is expected to be able to apply his/her thoughts to a model. In the competence dimension, the individual is expected to be able to base his/her experiences and conclusions on realistic grounds. Finally, in the competence dimension, the individual should be able to express and share his/her thoughts through effective communication in a way that others can understand.

The fact that individuals have the desired skills does not mean that they can use these skills when appropriate. Research shows that students are unable to use their thinking skills because they lack the necessary dispositions (Perkins, Farady and Bushey, 1991; Tishman, Jay and Perkins, 1993; Wendy, 1992). What makes an individual a good thinker is his/her tendency to research, seek clarity, take intellectual risks and think critically rather than his/her cognitive skills or abilities (Seferoğlu and Akbıyık, 2006). In a study conducted by the American Psychological Association (APA) in 1992, the claim that even if individuals have critical thinking skills, they may not be able to use these skills properly to receive support (Facione, 1990). Wolters and Pintrich (1998) argue that individuals with self-regulated learning skills should have critical thinking skills. Wolters and Pintrich (1998) state that an individual's critical approach in evaluating his/her own work and learning process will have a positive effect on development and learning. For this reason, the importance of studies to provide individuals with critical thinking skills in learning environments is emphasized.

Self-regulation is defined as the learner's ability to select, combine and coordinate cognitive strategies effectively (Boekaerts, 1999). Many researchers (Biggs, 1987; Entwistle, 1988; Pask, 1988) have explained learners' approach to learning as a characteristic means of control and organization of cognitive processes. When these two definitions are combined, it becomes clear that in order to explain the critical thinking skill, which is among the self-regulation skills, it is necessary to have information about students' learning approaches. In the literature, the relationship between learning approaches and self-regulation and therefore critical thinking is expressed in quantitative studies (Heikkila and Lonka, 2006; Heikkila, Niemivite and Niemine, 2010). Bigss et al. (2001) stated that individuals can be more successful in the learning process by using the learning approach they have in the learning process by providing faster learning. Biggs et al. (2001) specified that motivation is an important factor in the learning process and emphasized its relationship with the strategies and approaches used in the study process.

For individuals with surface learning approach, the product obtained at the end of the process is more important than the content of the subject. The most important factors affecting them in their studies are fear of failure, and extrinsic motivation sources including the influence of family, friends and environment on them. In the learning process, instead of trying to understand the given subject, they try to memorize it. They memorize information that is important for assessment. This situation causes them to be unable to establish relationships between subjects, concepts and facts and to provide integrity. Thus, instead of permanent learning, they perform memorization-based, short-term learning. Individuals with deep learning approach realize their learning in line with their own wishes. For them, their own opinions and desires are important, not the opinions of others about their learning, and their interests are the source of motivation. They are in constant search for understanding the subject and the material. They interact strongly with the content of the subject matter and have a broad perspective and relate ideas to each other. Their learning progresses in parallel with their personal and professional development. Instead of memorizing, they try to understand the subjects and relate them to other courses and daily life. Their learning develops as a whole, they do not focus on a single point and give the same importance to the whole subject. They have a strong tendency to read and try to learn more than what is given in the lessons. Individuals with strategic learning approach are motivated by getting high grades and being successful. They organize their time and try to distribute their efforts most effectively. The aim here is to achieve high success in the shortest time with the least effort. They make sure that the environment and materials are suitable for learning. They try to predict the questions in the upcoming exam by looking at the questions asked in previous exams. Unlike individuals with a deep approach, they do not study the whole subject but only the parts they deem necessary. In the strategic approach, individuals' knowledge and comprehension levels about the subject may vary (Gregorc, 1976).

Many strategies and tools can be used to develop critical thinking in learners. Portfolio is one of the tools that can be used to develop critical thinking. Portfolios are used both as a learning tool and as an assessment tool in education. The use of portfolios is one of the alternative measurement and evaluation methods that emerged with the deficiencies

in traditional teaching approaches to measure the behaviors expected from students (Birenbaum and Dochy, 1996). Portfolios were first used in the field of education towards the end of the 1980s and were developed in the 90s (Belanoff and Dickson, 1991; Odabaşı Çimer, 2011). Paulson et al. (1991) defined a portfolio as “a collection in which a student exhibits his/her efforts, development and achievements in one or more areas in line with a specific purpose“. Hamp-Lyons (1996) identifies the portfolio as "...the text that students write throughout the process includes evidence that shows the stages in the writing process, reflecting the writer's development as a writer, the writer's identity and progress as a writer". The definition of portfolio has changed and evolved over time. For example, previous definitions included student participation in selecting performance evidence and determining the content, and student self-assessment (Doğan, 2001). According to Barret (2005) "...it is the collection of work that demonstrates students' efforts, development and achievements in one or more areas throughout the process for a specific purpose. This collection includes student participation in the selection of content, selection criteria, criteria for assessing their abilities, and self-reflective evidence. A portfolio can be used as an effective tool in the performance of 'logical and reflective thinking focused on deciding what to do and what to believe' (Ennis, 1985). A review of the literature showed that the studies in which learning approach, critical thinking and portfolio were used together were very limited. It was seen that there were mostly studies in which the learning approach and critical thinking were examined together (Güven and Kürüm, 2006; Beşoluk and Önder, 2010; Pai and Eng, 2013). Considering all these variables, it is thought that examining the effect of the use of the portfolio on the development of critical thinking skills of pre-service teachers with different learning approaches will contribute to the determination of the factors that have an effect on the development of critical thinking. The research questions are as follows:

- What is the effect of portfolio use on the critical thinking strategies of pre-service teachers who use surface approach to learning?
- What is the effect of portfolio use on the critical thinking strategies of pre-service teachers who use deep approach to learning?
- What is the effect of portfolio use on the critical thinking strategies of pre-service teachers who use strategic approach to learning?

MATERIALS AND METHODS

The study used a case study design. Since the research aims to examine an existing situation in depth and to reveal detailed results, the most appropriate method is considered to be case study research (Kıncal, 2017).

Sample and sampling procedure

The sample of the study consisted of 26 pre-service biology teachers (20 females and 6 males) in 4th grade. The sample was selected using the convenience sampling method.

Data collection tools and process

The Study Process Questionnaire Scale and semi-structured interviews were used to collect the data. The Study Process Questionnaire developed by Biggs (2001) was adapted into Turkish by Orhan and Yılmaz (2011). In the adaptation study, after the linguistic equivalence of the Turkish form was ensured, it was applied to 400 university students. Cronbach's alpha coefficient was calculated to determine the reliability of the scale. The Cronbach alpha coefficient of the deep approach factor was 0.79 and the Cronbach alpha coefficient of the surface approach factor was 0.73. The Cronbach alpha values of both sub-dimensions of the scale applied to twenty-six people were 0.64 for the deep approach factor and 0.7 for the surface approach factor.

The applications made during the research process week by week are given below:

1. Application of The Study Process Questionnaire and Pre-interviews: Semi-structured interviews were conducted with 26 pre-service teachers who participated in the study to reveal their thoughts about critical thinking strategies. Pre-interviews were organized with the pre-service teachers to determine their prior knowledge before the study during the process.
2. Introducing the portfolio and portfolio writing: A presentation was made about what the portfolio is, what should be included in the portfolio and what should not be included, and how the portfolio would be evaluated. Three questions were asked in the portfolio that they were asked to answer. These questions were asked to be answered based on the lesson learned each week. Questions: What did I learn? What didn't I learn? What did I do to fix what I couldn't learn?
3. Portfolio writing - defining and applying reflective thinking and reflective writing: A presentation on reflective thinking and reflective writing was made in order to help teacher candidates write their portfolios with a critical approach and to increase the effectiveness of the portfolio. Worksheets with case studies including the levels of reflective writing were brought to the class. The class was divided into 6 groups of 5 each, and each group was given the same worksheet, and they were asked to explain at what level the texts on the papers were written, along with their reasons. Reflective writing has 4 levels (Moon, 2004). It was stated that the participants were expected to write at the 4th level in the portfolios they prepared.
4. Portfolio writing - Technique of taking notes – Feedback – Exam: At the end of the lesson, exams prepared for the

subject of the lesson were held.
5. Portfolio writing - Timeline preparation – Feedback: Portfolio writing and feedback continued. In addition, pre-service teachers were informed about the use of time, and they were asked to prepare a timetable showing how much time they spent studying each day.
6. Portfolio writing - Goal setting – Exam – Feedback: Portfolio writing and feedback continued. In order to monitor the effectiveness of the portfolio and contribute to the development of goal-setting strategies by pre-service teachers, a presentation was made on goal setting and a discussion environment was created.
7. Portfolio writing - Feedback
8. Portfolio writing – Exam - Feedback
9. Portfolio writing - Feedback
10. Portfolio writing - Feedback
11th and 12th week post - Interviews

Data analysis

The data were analyzed with the descriptive analysis method. The data are summarized and interpreted according to predetermined themes. The data was evaluated based on the research questions, in descriptive analysis, direct quotations are often used to reflect the views of the interviewed or observed individuals strikingly (Yıldırım and Şimşek, 2008). The interviews were first transcribed. In the first stage, the interviews were completely written. Then, the data were reduced to be appropriate to the subject and problem situation. The reduced data were read over and over again to ensure that they were understood and interpreted in terms of meaning, the cause-effect relationship was analyzed and some conclusions were reached (Yıldırım and Şimşek, 2008).

RESULTS

The results based on the research questions are presented below:

What is the effect of portfolio use on the critical thinking strategies of pre-service teachers who use surface approach to learning?

The pre-service teachers with a surface learning approach had the skills of questioning, interpretation, comprehensive thinking and asking questions within the scope of critical thinking skills. It was seen from the pre-interviews that the pre-service teachers had different approaches to critical thinking it was revealed that 50% of them do not question the subjects taught in the lesson or what they read, instead they completely adhere to what the teachers say. The following extracts reveal their ideas about questioning:

"I take out questions and repeat them constantly. What I can understand is the summary, I write down what the teacher considers important, the rest is not important." (P.T.10)
While repeating, I especially pay attention to what the teacher emphasized too much, what he/she may ask, for example, if I have a question about it, I look at them. I look at the notes I took while summarizing, the things the teacher emphasized, and the things I underlined. (P.T.22)

Forty percent (40%) of the pre-service teachers stated that they made their studies more comprehensive during their learning. For example, P.T.22 expressed the issue of making what they learned more comprehensive as follows*: "I wanted to learn about DNA, first I researched it from books, then I looked at it more comprehensively and more generally, then I watched a documentary on that subject."* (P.T.22). Also, P.T.16 stated that she tried to develop her own thoughts about what she learned in the lesson.

Last semester in biology, we took lessons on the use of biology in daily life, and this time, how can I really use it in daily life, for example, I started to eat a plant that I have never eaten in plants, for example, now, how can I apply most things in my daily life in this way, and how can I transfer this to the students, is this useful for me? (P.T.16)

It was seen that the portfolio process was effective in questioning, systematic study, using time, searching for reasons and thinking deeply on the subjects, which are among the requirements of critical thinking. Eighty percent (80%) of the pre-service teachers stated that they changed their behavior in questioning and evaluating themselves as a result of portfolio studies.

The following excerpts revealed their views about questioning and changing behavior;

"I said, "Here, in terms of time, I said, what else could it be, it could be self-confidence, it could be thinking, as I said, I started to think about what I did and what I couldn't do, why I couldn't do it, I started to think about these things." (P.T.10)) "I question myself about what I did, what I understood in this lesson, what I didn't understand, why I didn't understand this subject." (P.T.22) "The portfolio had something like this. What did I learn today, what do I need to do, what am I missing? Is there anything I'm missing? No, go on. It had such an advantage. I evaluated myself." (P.T.3) "I felt that I was questioning myself all day long, 'am I doing something, am I not doing something, what did I do, what did I not do?'" (P.T.16)

Thirty percent (30%) of the pre-service teachers stated that the portfolio study revealed what they should do and how they should work while studying. They stated that they created a more systematic way of working thanks to these studies. P.T.16 expressed her thoughts on how she should work as follows:

These small exams showed me what I didn't pay attention to, I saw how I should work, I saw that I had a lot of time with this timetable, I could have gotten to better places, I could have done better things, I wish I had tightened myself a little bit, I regretted many things, to be honest. (P.T.16)

Fifty percent (50%) of the pre-service teachers stated that they had to think about how they used their time with the studies. It was seen that the portfolio study was effective in using time well, which is one of the pillars of using resources correctly, which is one of the requirements of reflective thinking. The pre-service teachers stated that the timelines they prepared during the semester caused them to think about how much they worked. The following comments contain their opinions about the effect of timelines.

"*You know how you gave a timeline? For example, it also has an effect. In the timeline, I could see what I did, and this makes me evaluate what I did, what I did, what I did well." (P.T.3) "After I filled in the portfolio, I also used the timeline, I wish I had made more effort, I wish I had pursued my goals, I wish I had not paid attention to anyone because I had a lot of free time and I could have done better things." (P.T.16)*
How did it help? It had more effect on the measurement. If it had been left for later, maybe I would have forgotten, I wouldn't have been able to handle it, I would have skipped the exam. But I did it in time, I did it when the subjects were fresh, I understood better, I solved questions, for example, from KPSS books. (P.T.10)
I had too many classes. I definitely should have started this earlier. In that sense, to show that I misused the time. I mean, it wasn't such a small amount of time that was wasted. When you look at it, such big times accumulate, little by little. (P.T.22)

Thirty percent (30%) of the pre-service teachers stated that writing portfolios forced them to think about the subjects during their studies. Three questions were asked during the preparation of portfolios-What did you learn? What did you not learn? What did you do to overcome what you did not learn?"- The answers to these three questions encouraged the pre-service teachers to think about the subjects.

"You make an effort to learn a lesson in that subject, you make an effort to understand the lesson better, what I don't understand, what I have to write, so I have to study the subject again. It has a positive effect." (P.T.16)

"You know, the reasons, why I did it like this, or why I didn't do it like this, or why I couldn't do it, or why it failed, you know, I wouldn't have thought about the answers to these before, but now I started to think about them, the answers to these now." (P.T.5)

The pre-service teachers stated that the exams at the end of the course helped them to think about the reasons for their behaviors during the exam and to make changes. The statement of P.T.16 summarizes this view: "*Since we have been doing this portfolio, the teacher has been giving us small exams, and at the end of the lesson, I realized how careless and excited I was, for example, when I take the exam, I read the questions more."* (P.T.16) One of the pre-service teachers (P.T.22) stated that the exams triggered them to think about their deficiencies.

I learned that subject, and I solved the question on that subject at the end of the year because there were already 10 questions in that small exam. One of those 10 questions came out at the end of the year and I had learned all of them because I had learned how to do the questions I couldn't solve and how to do the wrong question correctly. The teacher told me the right answer. You should have thought like this there. I realized where I was thinking wrong and I didn't apply it in the exam at the end of the year, so I didn't make a mistake. (P.T.22)

The pre-service teachers stated that the studies were effective in raising their awareness at first and that thinking in this way led to behavioral changes over time.

For example, I said it would have been better to do this, it would have been better to do that. I mean, I had to do that. I was supposed to turn what I said would have been better into action, into an action in real life, but I didn't do that. I did that in the last portfolio I wrote. It was supposed to be this, I did that. You know, for example, I was supposed to solve questions because I learned this subject. I need to reinforce it, I need to solve questions for it, and I did that. I turned it into action. (P.T.22)

What should I do? First of all, I shouldn't take notes by reading. First I read and then I see the most important places in my head, you know, short notes. I have always taken long notes until now. It is as if I am taking that information and writing it down. However, I had to put what I learned there in my own words, in the form of a note. At this point, it was useful again because I realized this in my last studies. (P.T.10)

One of the pre-service teachers stated that she tried to use different sources to overcome her deficiencies while writing her portfolio. She stated that she did not have such a need in her previous studies, but with these studies, this became a necessity and she adopted it.

"You have to do research. When I needed to do research, I used to use Uncle Google. If there was a blog site, I would take notes from there, I would search, I would look for things you asked me to do, and when I looked for them, they would also contribute." (P.T.3)

As a result, it was determined that pre-service teachers with a surface learning approach improved their skills of questioning and thinking about their learning through portfolio work. In addition to these, it was determined that the study of preparing a timetable on the organization of time, which was not emphasized by the pre-service teachers in the pre-interviews, caused them to realize the deficiencies and organize the time.

What is the effect of portfolio use on the critical thinking strategies of pre-service teachers who use deep approach to learning?

It was observed that pre-service teachers with deep learning approach had questioning, associating, asking questions and thinking development approaches in relation to critical thinking strategies. In response to the question "What do you do to develop your own thoughts about what you have learned in this course?" 50% of the pre-service teachers answered that they associate or make connections between what they have learned and what they already know. Below are excerpts of their opinions.

"When I study a subject, I can think of everything about it in my head, I can associate it with other subjects, if I understand it, I can make associations. Apart from that, when I look at interpretation questions, I can easily solve those questions." (P.T.18)
"I make connections with other courses. After all, our current courses are generally a little more complicated than the previous ones and there is always the same information. So I make connections, I usually do nothing else." (P.T.23)
"When I learn a new subject or something new, I want to associate it with other things. I mean, I want to see what it can be and where I can use it." (P.T.12)

Instead of questioning the information, P.T.9 and P.T.11 stated that they considered the topics emphasized by the teacher important: "*I only study what the teacher emphasizes in the lesson*." *(P.T.9)* and "*I do not study everything, I study the notes given by the teacher, I do not study everything in the book." (P.T.11).*

Forty percent (40%) of the pre-service teachers stated that they questioned whether the subjects they learned during the course were necessary or not and what else was available on the subject. Regarding questioning, P.T.17 said, "*I try to investigate what is in it, what else has been done more deeply, what has been done up to date. I don't have a specific plan when I do this."* and P.T.12 used similar expressions.

For example, we come across such information that we learn for the sake of learning. We study genetics, we study molecular genetics. You know, I question it, you know, it's not like that, you know, there is the cliché 'oh teacher, what good will this do for us'. It's not like that, I really question whether it is necessary or unnecessary. (P.T.12)

P.T.12 stated that she asked herself questions to determine the effectiveness of her study:

I need to know other things so that even if I understand a part of it, as I said, when I go to the blackboard or to myself or if I am going to take an exam, I ask myself the questions that someone might ask me. What can he ask, what more can he ask? When I cannot answer that question myself, I feel the need to learn the part in between (P.T.12).

Again, P.T.12 said; "*If I were a teacher or a biologist or if I were to do something from such an open window, I say, how can I really interpret this information. How can I relate it to my daily life or my job?"* (P.T.12), showing that he thought about how he could use and interpret what he learned in the future and that he had a critical approach.

On the contrary, another pre-service teacher stated that since they were focused on the exam, they re-studied the subjects that they would encounter if they were asked in the exam. Here, too, it is not important what the subject learned is, but the fact that it will be asked in the exam.

To put it bluntly, we are students here, we are studying for the exam, in the extra exam you say I did this wrong and you look at that subject again, you know, if the only deterrent is that the teacher may ask it again, I mean, if you know for sure that it will not be asked again in that exam, you will not look at it again. They wouldn't look at it because they think, "I'm conflicted here, I need to learn." (P.T.20)

The findings obtained about how and in what direction the studies conducted with pre-service teachers throughout the semester and the portfolios they prepared had an impact on their critical thinking skills are given below.

Pre-service teachers stated that portfolio work was effective on critical thinking skills such as self-criticism, questioning and examining, asking questions, thinking about the subject, searching for reasons, evaluating and finding solutions.

Twenty-five percent (25%) of the pre-service teachers stated that portfolio work caused them to evaluate themselves and make self-criticism. Regarding this, P.T.18 mentioned the effect of portfolio study on identifying and eliminating their deficiencies; "*In portfolios, I can realize which subject I am deficient in and which subject I am complete in, so I focus more on the subject I am deficient in, and thus I can cover those deficiencies and be more comfortable in the exam, so it was good in that respect.*" Similarly, P.T.19 expressed her gaining a critical perspective as follows;" *I mean, there was no need for someone. I didn't need someone to tell me to study more, because I think I finally got to that point by criticizing myself. In a way, an internal motivation came."* Examples

of other pre-service teachers' views on this issue are given below.

I was also going to say that after learning the portfolio together with reflective thinking, I had the chance to see and evaluate myself more clearly and more objectively. I can say that it made me feel one step ahead of other people. (P.T.12)
For example, that day in class, I didn't think 'I couldn't learn because of my absent-mindedness', I just thought 'I couldn't learn'. But now I can easily write in my portfolio that it was because of my own absent-mindedness. In that respect, I saw myself more open, I mean more open to self-criticism, let me put it in terms of myself (P.T.20)

Twenty-five percent (25%) of the pre-service teachers stated that the portfolio study contributed to questioning and analyzing the subjects they learned. P.T.14 expressed this situation as follows; *"I listened better, I listened by focusing more on such small points. I asked myself a lot of questions to see if I understood this, it helped me."* Similarly, P.T.11 said, *"I started to scrutinize more, why I did not understand what I did not understand, or why I solved the questions I solved, etc."* and pointed out that he thought about what he did not understand, and P.T.18 said, *"What did it add? It made me question myself a little more, it increased my sense of responsibility, it caused me to think more broadly, to think more creatively."* He pointed out the increase in the sense of responsibility and questioning ability. Examples of other pre-service teachers' views on this issue are given below.

The portfolio was very good for me, I mean, at least when I open it and look at it, I can see the things I can do, I can see the things I can't do, I can see the things I'm missing, so it gave me the opportunity to question myself from nothing, in this sense, it was a very good study. (P.T.4)
As I said, I can question myself now, I didn't need to before, but now I really do it compulsorily, and since we have been doing this for a certain period of time, it has become ingrained in the body and one will inevitably question oneself constantly. (P.T.20)

Pre-service teachers were asked to set goals for themselves and to explain and think critically about what they did while achieving these goals. 25% of the pre-service teachers stated that the studies were effective in making them think critically about the subjects they learned in the lessons and their goals. P.T.12 expressed this as follows; *"... yes, I have done this, apart from that I have not done that, I need to do that, this is a plus for me, seeing it there had a great effect on it."* Other pre-service teachers expressed similar opinions:

Because the reasons, why, for example, I didn't learn, I say I was sleep deprived in some lessons, I say I didn't learn, but I wrote down why I was sleep deprived, there was a reason, for example, I couldn't listen to the lesson, you pay attention to it the next week, for example. When I'm sleep-deprived, I miss the lesson, so I need to review my sleep patterns, that's what you think. (P.T.19)
It taught me not to spend too much time on what I understood, it taught me to concentrate more on what I didn't understand, to repeat it, to try to understand it, and if I didn't understand it, to think about why, to find those reasons and to find a solution on them. (P.T.25)
Those goals actually made me realize some things about my life and revealed that I wanted to improve things a little more. Actually, I wanted to do these things, but I never expressed them or they seemed too far away to me. (P.T.4)

The pre-service teachers stated that the exams at the end of the course encouraged them to constantly think about their deficiencies, to search for the reasons and to generate ideas about what they should do about them.

It is very useful because it provides you with a plus repetition of what you have grasped and what you haven't grasped in the heat of the moment, for example, when I was leaving, for example, I was thinking about it, for example, why I did it wrong, did I not learn it, or did I not see it, it is an application that has pluses for myself, I think about whether there are any minuses. (P.T.12)
You missed some parts, but at the end of the lesson, in the quizzes, you suddenly face what you said you just understood, or when you face what you will face in the exam right after you learn it, when you go home and face that confrontation, you make an effort to do your best. (P.T.24)
I started to find my mistakes by thinking more, before I didn't think much, if I understood a lesson, that was it for me, but now I think, what are my mistakes? I wonder where I am making mistakes, how I can find them and how I can correct them. (P.T.25)

The pre-service teachers also stated that the studies encouraged them to see their deficiencies and to try new methods to overcome these deficiencies. Therefore, the portfolio study contributed to deep learners to find a solution to the situation encountered, which is a skill of critical thinking.

For example, if I repeat it once, I repeat it twice, or I take notes in a different way, I read it every day, I go like that, I do different things in that way, or let's say I do coding, I adapt it to other things in my head, I try to learn by adapting it to something in daily life. (P.T.20)
For example, what am I missing, let's say I'm studying the subject, I'm solving tests, especially there, it's usually the case that there is either a deficiency or something has happened in the questions on a subject. Then I look at what and where I missed, I go back again, if not, I look at it again from another source, I worked in that way, I both do it and

check myself. (P.T.7)

As a result, it was determined that pre-service teachers with deep learning approach used critical thinking strategies more effectively in their pre-interviews compared to other learning approaches. When the post-interviews and portfolios were analyzed, it was seen that pre-service teachers improved themselves in self-criticism, self-evaluation and questioning.

What is the effect of portfolio use on the critical thinking strategies of pre-service teachers who use strategic approach to learning?

In the pre-interviews, although some pre-service teachers stated that they questioned themselves and the subject matter during their studies, it was observed that they were generally lacking in questioning the subjects. Apart from this, it is seen that some pre-service teachers have skills such as establishing relationships, asking questions and developing ideas while learning subjects. When we look at the answers given to the questions asked about critical thinking in the pre-interviews with pre-service teachers, it is noticeable that pre-service teachers do not know what critical thinking skill.

Sixty percent (60%) of the pre-service teachers stated that they considered the topics emphasized by the teacher important instead of questioning the information. Regarding this issue, P.T.21 said, *"When I summarize, I try to write down the places where the teacher says that this place is certain, this place is very important, since I summarize for the exam, I try to write them more clearly."* and P.T.22 said, "*We take notes of the subjects one by one in order. When we write down our own notes and the important things in the book and the important things we remember from the teacher, we have already written everything. That's how we do well in exams."* His statements point to this situation.

Twenty-five percent (25%) of the pre-service teachers stated that instead of developing ideas during their studies, they identified important points on their own and went through them. In the interviews, the pre-service teachers said, *"I don't write too much detail, I do so, especially in education courses on the subject. I usually write the important points"* (P.T.1); *"I try to take notes, normally there are always more empty sentences in books, but when I read like this, I try to take the most important ones. Short and concise sentences that I exemplify in a way that will stay in my mind."* (P.T.8) and *"When I am going to learn a new subject myself, I first research it on the internet, look at it from different places, and then I do not use a different reading technique. I try to learn the parts that I consider important by reading and underlining them."* (P.T.13) shows that they identify the parts that they think are likely to appear in the exam as important and emphasize them.

Twenty-five percent (25%) of the pre-service teachers explained that they tried to develop their own ideas during their studies, and they tried to establish relationships, make connections and express them with their own sentences.

When it is long, you can miss the subject, but in short things, the teacher gives a definition, it is too long, I can associate it in my head and I explain it with examples as I associate it, I take notes, then I do not forget it. When I study the subject later, I take short notes in this way. (P.T.8)
I try to associate it with other courses and subjects I have seen, so it is like this, keeping it in my mind. I didn't do anything like direct memorization. Or as I said, I need to visualize it in my mind, I need to think about it, I mean, it is very difficult for me to keep it in my mind just by memorizing the text directly. (P.T.21)

Similarly, P.T.21 stated that she learned by associating the subjects by saying *"Since biology lessons are about living things, I usually try to establish relationships."*; P.T.1 stated that she learned by associating the subjects by saying *"When I read it for the second time, I have the opportunity to read it, then I try to explain it again with my own sentences in this way, I remember it when I look at it. I create definitions for myself from the definitions written in the books."* She stated that instead of memorizing, she tried to understand and express it with her own sentences.

The pre-service teachers stated that they used questioning and research to make the subject more logical during their studies. P.T.1's statement on this subject is exemplary of the thoughts of other pre-service teachers; *"If it does not fit my logic, I first ask the teacher; the teacher probably learned it that way, but if it does not fit me, I will definitely research it."*

It was revealed that pre-service teachers improved in the areas of questioning, time use, searching for reasons and finding solutions. The pre-service teachers stated that the portfolio study helped them realize their deficiencies and that it caused them to focus more on the subjects. However, only a situation determination is made.

For example, after the first midterm, our teacher gave us the questions again, you know, to see what you did wrong, what you did right, I paid attention to what I did or what I couldn't do, which subject I had problems with. For example, while writing the portfolio, we think about what we lack and what we have more of, and I wrote them down in my agenda so that they would come out in the final. (P.T.1)
I wrote in my portfolio that I was deficient in such and such a way, so I did such and such a study, I solved questions, or I asked the teacher, or I did it again, I reread the subject from the beginning, the teacher already explains it, you ask the teacher a question about the question you could not do, and the teacher explains it, and it helped me to correct it. (P.T.26)

During the semester, pre-service teachers were asked to prepare timetables within the scope of the study. It came out that the timetables helped them to evaluate themselves in terms of using time and change their behavior in this regard. The following excerpt supports this:

For example, we had already talked about whether I had studied, when I had studied, how much I had studied, sometimes I didn't study at all during the week, it made me examine what I had done all week. Then I paid attention, I said, I was not studying, so I should at least squeeze in some lessons in between so that I could study (P.T.26)

Critical thinking skills include identifying, recognizing and finding solutions to the existing situation. In relation to this, pre-service teachers stated that they approached their study methods more critically and made some changes in their behaviors with the studies conducted.

The findings show that writing a portfolio helps the pre-service teachers to identify the problem and move towards a solution. Similarly, the following pre-service teachers identified and corrected their mistakes in the way they worked.

"I realized that I wanted to find a solution, I didn't do anything like this before, I didn't know what my problem was, so when I came to the lesson and wrote a portfolio, I thought, 'Oh, if I'm really doing this, I should fix it'." (P.T 1).
I told myself that it would be better if I did this and that, I told myself that if I told myself these things, I had to do them, I did them, I solved some problems, I eliminated my deficiencies, I gained skills, and this skill helped me to be better in the lesson. For example, you see what you cannot do, you take notes accordingly, you can create a listening style accordingly, for example, these two examples happened for me. (P.T.8)
I mean, let me put it this way, maybe sometimes I think I was always working on what I knew, but in the portfolio, I realized what I lacked and started working on it. I was not aware of my deficiencies before, and I realized that I was working more on what I knew. (P.T.1)

The study revealed that the questions the pre-service teachers were asked while writing their portfolios pushed them to criticize and question themselves. The following statements are an example of this.
"When I had the portfolio, I was writing it the day before, I had the opportunity to think about what we did in the lesson again, for example, when I wrote the portfolio, I realized that I really questioned myself while writing down why our thoughts were like this and why they were not like this." (P.T.8).
"I criticized myself, I saw my own shortcomings there, in some cases I tried to complete it, in some cases maybe I did not complete it." (P.T.13);
"I mean, when I took them into account, I thought about what I was going to write in more detail and wrote down everything I did, so I didn't know what I did.); "I mean, when I took them into consideration, it made me think about what I was going to write in more detail and write down everything I did, that is, what I did to see what I did to see what I don't know." (P.T.21)
We had stages in the portfolios, what did I learn, what did I not learn, what did I do to overcome what I did not learn, these questions made me question myself. For example, I didn't understand this part of this subject, why didn't I understand it, why didn't I understand it, why could I not understand it, because, for example, we make comparisons, so it means that I was lacking in comparison, so I couldn't answer the questions in the comparison questions, so I couldn't answer the questions in the comparison questions, so I couldn't reach this level (P.T.26)

It was found that showing the exams at the end of the course to the students again and solving them in the classroom helped them to have a critical approach to see their deficiencies and how to overcome them.

In the first exam I took, I thought I understood the subject very well, but when I couldn't do the questions, I realized that I didn't, so I listened better in the next lesson and thought about what I could do in terms of solving questions, then the teacher gave me an exam, but I did a full score in that exam, and then I felt relieved. (P.T.21)
It helped me to repeat the subject, to determine whether there are points that I am missing, and if there are places that I have determined, it caused me to strive for them, to solve questions, to start over again, to ask my friends, to do such studies. (P.T.26)

The pre-service teachers stated that the portfolios had an effect on their working method and self-reflection. *"Honestly, teacher, I learned how to see yourself with the portfolio. We write what you tell us and how we work or why we work there, so it helped me to see something. But it did not make a change."(P.T. 21).*

Again, P.T.26 stated that she wrote the portfolio just to write instead of improving herself or evaluating herself critically and benefiting from it; *"I never did anything by looking at it, I mean, I know these things, I don't know these things, what are the pros and cons, I didn't do that, I just wrote it, I tried to write better."*

As a result, it was seen that pre-service teachers with strategic learning approach emphasized only questioning among critical thinking strategies in the pre-interviews. When the post-interviews and portfolio studies were examined, it was determined that the pre-service teachers emphasized questioning, finding solutions, searching for reasons and using time through the studies.

DISCUSSION AND CONCLUSION

In the pre-interviews, it was found that the pre-service

teachers had the skills of questioning what they learned and asking questions. It was seen that the critical thinking skills of pre-service teachers who adopt surface learning approach were at a lower level. Pre-service teachers with surface learning approach gained the skills of questioning what they learned, time use, systematic thinking and study skills through the studies. Pre-service teachers with deep learning approach had the skills of questioning, establishing relationships between subjects and setting goals for themselves while working. And, that the use of portfolios improved pre-service teachers' self-evaluation and criticism. In the pre-interviews with pre-service teachers, it was seen that pre-service teachers with strategic learning approach had only questioning and establishing relationships between subjects in terms of critical thinking skills. Through the use of portfolios, pre-service teachers improved themselves in questioning what they learned, using time and finding solutions. It was determined that pre-service teachers with strategic and deep learning approaches differed from pre-service teachers with surface learning approaches in terms of establishing relationships between the subjects they learned. It was determined that the group with the most critical thinking skills among the pre-service teachers was the pre-service teachers with deep learning approach. It was seen that the skills of finding a solution to the problem encountered, which is one of the critical thinking skills of pre-service teachers with deep learning approach and pre-service teachers with strategic learning approach, developed through the portfolio.

Several researchers stated that characteristics such as analytical thinking, curiosity, self-confidence and truth-seeking are important in critical thinking and that these characteristics increase academic achievement (Ennis, 1991; Fisher, 1995). This study found differences between the critical thinking skills of individuals with different learning approaches in the pre-interviews and post-interviews. In all learning approaches, it was found that individuals tend to question the subject they have learned. There was a significant change in the questioning dimension especially in surface learners. Researchers revealed that surface learners have an approach toward memorization rather than a questioning approach in learning environments (Biggs, 1993; Bloom and Severiens, 2008; Heikkila and Lonka, 2006; Lublin, 2003; Rosario et al., 2010). However, in this study, the questions asked in the process of portfolio use (What did I learn? What did I not learn? What did I do to overcome what I did not learn?), motivated individuals to question themselves. Individuals were given the opportunity to reflect on their own work and learning. In the questioning dimension, it was observed that there was a change from surface learners to deep learners. Within the scope of the study, pre-service teachers were also supported in developing their reflective thinking and reflective writing skills. It is thought that writing the portfolios they prepared with this approach improved them in terms of questioning. With the feedback given throughout the process, the participants had to question their work.

It was observed that pre-service teachers with a deep learning approach were successful in making associations and establishing relationships between subjects and events. In addition, they were also found to be more successful in questioning than the others. Heikkila et al. (2010) stated that individuals with a deep learning approach have higher levels of critical thinking skills and develop themselves in different directions compared to others. It was observed that individuals with a deep learning approach improved themselves in terms of self-evaluation, self-criticism and finding solutions to problems encountered. It is thought that some of the questions that the participants had to answer during the portfolio process guided them to criticize themselves and their learning. Since the current education system and assessment and evaluation approaches are generally aimed at evaluating students with exams at the end of the process, they provide individuals with graded feedback rather than written feedback. Although this situation shows where and in which subject the learner has made a mistake, it does not provide an effect at the point of revealing the reasons for this. Since portfolios give individuals the opportunity to evaluate and criticize themselves week by week before the exam rather than in the exam, they contribute to the positive impact on their own learning by providing the opportunity to develop these skills. In addition, with the exams at the end of the lesson, it was determined which subjects they were deficient in at that moment and helped them to resolve this situation as soon as possible.

It was observed that pre-service teachers with a strategic learning approach improved the most in finding solutions to problems encountered among critical thinking skills. This could be attributed to the exams and effective feedback given at the end of the course. Considering that individuals with a strategic learning approach are normally effective in finding short solutions to the problems they encounter, it can be said that portfolio use positively improves this existing skill.

RECOMMENDATIONS

In summary, when all the study approaches are compared, it is seen that critical thinking skills are not at a high level. However, it was seen that the portfolio had different effects on different learning approaches. One of the reasons the change is not high is that teaching environments are based on results and rote memorization (Sönmez, 1993). It is very difficult for students to acquire critical thinking and creative thinking skills in rote learning environments (Sönmez, 1993).

Portfolio has a positive effect on developing critical thinking. Here, it is effective to ask questions that will offer students the opportunity to criticize themselves and to guide them in self-criticism with feedback. In addition, within the scope of the lesson on reflective writing, pre-

service teachers, who are expected to write high-level articles, were given the opportunity to think about their learning while writing their portfolios and their behaviors during their learning, together with their reasons. It is thought that this contributes to their critical approach.

Portfolio was effective in developing critical thinking in pre-service teachers. For this reason, it is necessary to develop instructions and activities suitable for each learning approach by considering learning approaches in developing critical thinking in students.

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