Available online at ijci.wcci-international.org

International Journal of Curriculum and Instruction 15(1) (2022) 378–395

IJCI
International Journal of Curriculum and Instruction

Determining the learning approaches of biology teacher candidates

Aylin Güner Kahraman [a], Çiğdem Alev Özel [b]*

[a] *Ankara Şehit Mutlu Can Kılıç Ortaokulu, Ankara, 06790, Türkiye*
[b] *Gazi Eğitim Fakültesi, Biyoloji Eğitimi Ana Bilim Dalı, Ankara, 06560, Türkiye*

Abstract

Learning approaches refer to the differentiation in the purpose that students consider and the activities they choose to perform a particular learning task. Many studies have been carried out at university level, in various grade levels and fields, in order to determine the learning approaches of students and to enable them to learn to learn by enabling them to gain effective learning approaches in the light of these determinations. In this study, it was aimed to determine the learning approaches of biology teacher candidates. The study group of the research consists of 12 teacher candidates studying in the 2nd, 3rd, and 4th grades of Gazi Education Faculty, Department of Mathematics and Science Education, Biology Education Department in the fall semester of the 2022-2023 academic year. The teacher candidates were selected to be 12 teacher candidates from each grade level and 9 of the candidates were girls and 3 were boys. This study is a qualitative research and the data of the research were obtained by using a semi-structured interview form consisting of 5 questions developed by the researchers. In the analysis of the data, content analysis was used in qualitative data analysis methods. When the statements of the teacher candidates were examined, the results of the research showed that one of the learning objectives of the teacher candidates was the sense of curiosity and they aimed to improve themselves in the process based on learning. The results obtained as a result of the research indicate that some of the teacher candidates aim to get high grades, organize their studies, plan their time consciously and avoid memorization.

Keywords: Learning approach; in-depth learning; surface learning; strategic learning; teacher candidates

1. Introduction

One of the biggest problems faced by students in the 21st century is how to obtain knowledge in the rapidly changing world order. In this context, effective learning has become a necessity in the process we are in, as a process in which real learning is provided and thinking skills are put to work. Learning is an ongoing process at every

* Çiğdem Alev ÖZEL. ORCID ID.: https://orcid.org/ 0000-0002-5952-1412
E-mail address: cigdemozel@gazi.edu.tr

stage of life and throughout life. It is a relatively permanent change in behavior or potential behavior that occurs as a product of experience (Senemoglu, 2002). The definition of learning varies according to the perspective from which learning is viewed (Selcuk, 2003). Learning approaches express the differentiation in the purpose and activities students choose to perform a particular learning task (Entwistle & McCune, 2004). One of the main studies on learning approaches was done by Marton and Saljo (1976). In this study, in defining learning approaches, the researchers focused on how students approached reading an academic article, what their behavior was while reading the article, and what they learned after reading the article. They stated that learning approaches are the perspectives on the concept of learning that do not have a personality trait and change depending on the intentions of individuals.

Studies carried out in England and Sweden during the 1970s define three important learning approaches at higher education level as deep, superficial and strategic (Richardson, 2005). The deep learning approach is based on understanding the meaning of the course material, the surface learning approach is based on memorizing the course material for the purpose of evaluation, and the strategic learning approach is based on obtaining high grades (Richardson, 2005).

Entwistle (1997, cited in McLean, 2001) defines the deep learning approach as the aim of understanding the learning material because of interest, the surface learning approach as the aim of coping with the requirements of the course, and the strategic learning approach as the aim of getting the highest possible grade. The researcher states that the starting point in the deep learning approach is the students' sense of curiosity and this reveals the desire to learn. At the same time, in this approach, students associate new information with their prior learning and experiences during learning. In the surface learning approach, students perform a rote-based and non-permanent learning as a result of a purposeless or strategyless study process. Therefore, students feel under stress. In the strategic learning approach, the student's goal is to achieve success by getting the highest possible grade. In this context, learners make a continuous effort in their studies. They organize their work in this direction. In addition, students effectively provide time planning to eliminate missing learning during the study.

Studies are carried out to determine the learning approaches of students at various grade levels and fields in higher education. In the light of the results of these studies, other studies aiming to enable students to acquire effective learning approaches and learn to learn are also carried out. As a matter of fact, many findings obtained from studies in the literature indicate that students' learning approaches and study skills are important factors affecting the quality of learning (Senemoglu, 2011). Studies show that the characteristics of the learning environment, student achievement level, subject area, grade level and gender have an effect on students' learning approaches (Ellez & Sezgin, 2002; Sezgin-Selcuk, Caliskan, & Erol, 2007; Ekinci, 2008; Tural-Dincer & Akdeniz;

2008; Senemoglu, 2011; Zhang, 2000). It is important to reveal the approaches of pre-service teachers to the concept of learning and the reasons underlying the learning approaches they adopt in this context. As the teachers of tomorrow, it is of great importance to determine what kind of learning approaches the pre-service teachers have and to guide them to acquire effective learning approaches. If pre-service teachers use learning approaches and study skills effectively before the service, they can also develop effective learning approaches and study skills in their students (Senemoglu, 2011). Because the intention to act while dealing with a learning task also affects the quality of learning. From this point of view, it is aimed to determine the learning approaches of biology teacher candidates in this study.

2. Method

2.1. Research model

This study, which was carried out to determine the learning approaches of biology teacher candidates studying in the 2nd, 3rd and 4th grades in Gazi University, Gazi Education Faculty, Department of Mathematics and Science Education in the 2022-2023 academic year, is a descriptive study in the type of qualitative research.

2.2. Study group

The study group of the research consists of 12 pre-service teachers studying in the 2nd, 3rd and 4th grades of the Gazi Education Faculty, Department of Mathematics and Science Education, Department of Biology Education in the fall semester of the 2022-2023 academic year. The teacher candidates were selected to be 12 teacher candidates from each grade level and 9 of the candidates were girls and 3 were boys. In the study, the sample was determined based on the principle of convenience, and the purposeful sampling method was followed. In purposive sampling, individuals who are thought to serve the purpose of the research are selected (Cohen, Manion & Morrison, 2007). It is also advantageous because it allows for in-depth study of situations that are thought to have rich information (Yildirim & Simsek, 2008).

2.3. Data collection tool

In this study, which was carried out to determine the learning approaches of biology teacher candidates, a semi-structured interview form developed by the researchers was used. Semi-structured interviews consist of some key questions that help to understand the subject or area to be explored. However, it also allows differentiation in order to understand an answer or idea in more detail and in depth (Algan, 2015). During the preparation of the interview form, a literature review was conducted, and questions were formed based on the criteria determined within the framework of the information obtained. The prepared "Learning Approaches Interview Form" consists of 5 questions prepared to determine the learning approaches of teacher candidates. While writing the

interview questions, attention was paid to ensure that the questions were appropriate and understandable for the purpose of the research, and that they did not contain statements that led the interviewer. Another expert was consulted to ensure the internal validity of the semi-structured interview form prepared by the researchers. Necessary adjustments were made in line with the feedback received. For the calculation of reliability in qualitative data, Miles and Huberman (1994, p. 64) suggest the formula "Reliability = Number of Agreement / Number of Agreement + Number of Disagreement". Within the scope of this formula, the codes were determined by reading the data of 12 students together with a field expert, and the consistency between the researchers was determined as 0.82. The Interview Form, including the changes and developments in the literature on the learning approaches of the teacher candidates; It has been developed in three dimensions as deep, surface and strategic learning approaches. In the process of preparing the interview form, first of all, the studies in the related literature were reviewed and a 5-question form was created based on the criteria determined within the framework of the information obtained from the literature. The interview questions are as follows:

- What is your purpose in learning something new in general?
- What is important to you when taking an exam or studying for that course? Is it to learn a subject? Is it to get high marks? Or is it just to get a high grade on that exam? What is your main purpose?
- When working on a new topic, do you relate to previous knowledge?
- How do you carry out your planning while studying?
- How do you ensure time management while studying?
- *2.4. Data collection and analysis of data*

In order to determine the learning approaches of biology teacher candidates, data were collected by using semi-structured interview forms of 12 teacher candidates studying in the 2nd, 3rd and 4th grades of Gazi University, Gazi Education Faculty, Department of Mathematics and Science Education, Biology Education Department. During the data collection process, the scope of the research was explained to the teacher candidates and it was stated that they wanted to be interviewed on a voluntary basis. By contacting the volunteer teacher candidates, the place and time were determined and the semi-structured interviews were obtained by presenting the form to the teacher candidates in the determined place and time.

Content analysis was carried out in the analysis of qualitative data in order to reveal which learning approaches the biology teacher candidates have. The data obtained from the semi-structured interview form were analyzed by considering the basic characteristics of learning approaches. In content analysis, data are examined and reported according to the stages of coding the data, finding the themes, organizing the

data according to the codes and themes, defining and interpreting the findings (Yildirim & Simsek, 2013). The codes that emerged as a result of examining the data using an inductive approach were added to the code list. Yildirim and Simsek (2009) stated that general categories or themes were determined beforehand in the coding made within a general framework, but more detailed codes that could be included under these themes could emerge during the analysis of the data. In this study, a coding key was first created by the researchers in order to make the evaluation more accurate and easier. Significant units were found by examining the theoretical framework and all of the data. The expressions containing the codes were grouped according to their similarities and differences and turned into themes. The content analysis of the data is described under the themes of deep learning approach, surface learning approach and strategic learning approach. While creating themes and matching them with codes, the criteria used in describing Learning Approaches (Deep, Surface and Strategic Learning Approaches) in the literature were taken into consideration. In order to ensure internal validity in qualitative data, the data was constantly discussed with a field expert and critically examined. The codes and themes that emerged as a result of the examinations were further examined by researchers and a field expert. The codes and themes were rearranged and shaped according to the feedback given by the expert. Since the pre-service teachers' own sentences will be directly conveyed in the findings, each pre-service teacher is given with codes such as T1 , T2 , T3 …..

3. Results

In this study, which was conducted to determine the learning approaches of biology teacher candidates, 5 open-ended questions were asked to the teacher candidates. The codes and themes related to the answers given by the teacher candidates to the questions are presented in the tables below.

The first question to biology teacher candidates is, “What is your purpose in learning something new in general?” question was posed. Table 1 includes the frequency distributions and interpretations of the codes and themes obtained from the answers given by the teacher candidates within the scope of this question.

Table 1. Opinions of teacher candidates on learning purpose

Themes	Codes	f
In-Depth Learning Approach	Desire for self development	9

	Curiosity about the subject/information	3
Strategic Learning Approach	Giving impressive answers	1

In Table 1, it is seen that the answers given to the question are grouped under two themes. The teacher candidates expressed their general aims in learning in the theme of deep learning approach, desire for self-development (f=9) and in the dimensions of being curious about the subject/knowledge (f=3). Examples of the answers given by the teacher candidates are presented below.

T1: "...I learn new things with a sense of curiosity."

T8: "...my purpose in learning something new; improving myself, satisfying my curiosity and feeling self-sufficient."

T3: "…in my mental process, I learn something new in order to keep my mind active. I also believe that the only way to be a conscious, self-sufficient individual is to be open to learning new information and to improve oneself."

T4: "…learning new information about a subject that I am interested in helps me to improve myself and feel more self-confident. Therefore, my purpose in learning is to improve myself more."

As seen in Table 1, only 1 pre-service teacher explained her general purpose in learning under the theme of strategic learning approach. This pre-service teacher stated the general learning goal as giving impressive answers (f=1). The answer given by the pre-service teacher is presented below.

T10: "…it is my aim while studying to advance in a planned way by determining my goal. My purpose in learning something new is actually when I am asked a question, I want to give an accurate and impressive answer."

Secondly to the biology teacher candidates, "Is it important for you to learn a subject while studying for a course exam, to get high grades in general or just to get high grades from that exam? What is your main purpose?" question was posed. In Table 2 below, the frequency distributions of the codes and themes obtained from the answers given by the teacher candidates within the scope of this question are given.

Table 2. Opinions of teacher candidates on the purposes of studying for a course exam

Themes	Codes	f
In-Depth Learning Approach	Learning the subject/knowledge deeply, desire to comprehension and assimilation	7
Strategic Learning Approach	Getting high grades	5

In Table 2, it is seen that the answers given to the question are grouped under two themes. Pre-service teachers expressed their answers to this question in the theme of

deep learning approach, in the dimension of the learning the subject/knowledge deeply, desire to comprehension and assimilation (f=7). Examples of the answers given by the pre-service teachers are presented below.

T6: "…while studying for a course exam, it is more important for me to learn a subject than to get a high grade in that exam."

T11: "…that is, it is important to get high grades or have a high average. But it is more important to learn the subject in depth. After all, as a teacher, I will teach many students. Therefore, the more I develop myself and the more equipment I have, the better teacher I will be.

T12: "…while working on a subject, the important thing for me is to learn by grasping the subject. In order to get a high grade at that moment, it is not to memorize it, but to have permanent knowledge.

As seen in Table 2, 5 pre-service teachers explained their aims in studying for a course exam under the theme of strategic learning approach. Candidates stated their goals as getting high grades/efforts to be successful (f=5). Sample answers given by pre-service teachers are presented below.

T2: "…learning the subject, applying it successfully in my future life and keeping my grades high."

T3: "…The important thing is to learn by examining a subject in depth and to expand my knowledge base. Of course, since exams shape the future of our lives today, I work with this in mind when I study.

T9: "…My main goal is to learn the subject, and I aim to get high marks in the exams I take in order to test myself on the subjects I have learned."

As a third question to the biology teacher candidates, "Do you associate with previous knowledge while working on a new subject?" question was posed. In Table 3 below, the frequency distributions and interpretations of the codes and themes obtained from the answers given by the teacher candidates within the scope of this question are given.

Table 3. Opinions of Teacher Candidates on the Relationship Between Their Past and New Learning

Themes	Codes	f
In-Depth Learning Approach	Making connections between old learning and new learning	12

In Table 3, it is seen that the answers given to the question are gathered under a single theme. The pre-service teachers expressed their answers to this question under the theme of in-depth learning approach, in the dimension of establishing a relationship

between old learning and new learning (f=12). Examples of the answers given by the pre-service teachers are presented below.

T2: "…I establish relationships as much as I can remember."

T7: "…yes, I will. For example, in order to understand the events in the cell, it is necessary to know the cell well. So it builds on previous issues."

T11: "…yes, I will. Since most of the subjects in biology are related to the previous subject, I involuntarily make associations between the subject I learned and the new subject."

T12: "…yes, I establish a relationship. Because all subjects are related to each other. By learning the subject in a way, it not only helps me forget my past knowledge, but also facilitates learning the new subject."

Biology teacher candidates were then asked, "How do you plan while studying?" question was posed. In Table 4 below, the frequency distributions and interpretations of the codes and themes obtained from the answers given by the teacher candidates within the scope of this question are given.

Table 4. Opinions of Teacher Candidates on their Planning While Studying

Themes	Codes	f
Strategic Learning Approach	Planning, organizing and striving	10

In Table 4, it is seen that the answers given to the question are gathered under a single theme. The pre-service teachers expressed their answers to this question in the dimension of Planning, Organizing and Making Effort (f=10) in the theme of strategic learning approach. Examples of the answers given by the pre-service teachers are presented below.

T3: "…I make weekly and then daily plans. I make sure that the daily plans are at a level that I can do. I like working by organizing my day and I find it useful"

T4: "… my planning is usually by prioritizing the issues that I feel inadequate. I can't switch to a new topic until I have fully dealt with those issues. I like to plan regularly so that I don't get too bored."

T8: "…if the basic information is not clear to me, I focus on them first. Thus, I will not have difficulty in understanding the general information afterwards. I plan my lesson accordingly. Working with a plan also affects my success."

Finally, to the biology teacher candidates, "How do you manage time while studying?" question was posed. Table 5 includes the frequency distributions and interpretations of

the codes and themes obtained from the answers given by the pre-service teachers within the scope of this question.

Table 5. Opinions of Teacher Candidates on Time Management While Studying

Themes	Codes	f
Strategic Learning Approach	Planning Time	9

In Table 5, it is seen that the answers given to the question by the teacher candidates are gathered under a single theme. Pre-service teachers expressed their answers to this question in the strategic learning approach theme, in the dimension of time planning (f=9). Examples of the answers given by the pre-service teachers are presented below.

T1: "…first of all, I only work for 10 minutes and add rest time to focus. Then I multiply the time to 20 minutes, 30 minutes, 1 hour."

T4: "…I think I can use time very well. I'm not a big fan of taking breaks. I take a short break when I come to a place where I think I am good now, while I am working on the subject that I am lacking. This allows me to work more concentrated."

T7: "…I make plans according to the time I can spare daily. In other words, if I can spare 3 hours a day, I will focus on a longer topic, and if I can spare 1 hour, I will focus on a shorter topic. I definitely plan the time according to the content of the subject."

T9: "…I distribute my weekly tasks according to the days. I know what to do for the day. I also divide my time on the subjects I will study and plan accordingly."

4. Discussion

In this study, it was aimed to determine the learning approaches of biology teacher candidates and for this purpose, a form consisting of 5 open-ended questions was given to the teacher candidates. While conducting the content analysis, the basic criteria expressed by Beyaztas (2014) were taken into consideration. Beyaztas (2014) describes the deep learning approach; search for meaning, associating and organizing ideas/thoughts with each other, basing evidence/using evidence and being reasonable, being interested and willing to learn, and critical thinking. The researcher determined the surface learning approach as lack of purpose, being based on repetition and memorization, difficulty in understanding, dependence on the course content/topic, and fear of failure. Finally, the strategic learning approach was expressed as effective time management, organizing/organizing their work and exerting effort, focusing on success, paying attention to evaluation criteria, and observing/monitoring effectiveness. In-depth learning approach is defined in the literature as an approach in which the learner

associates previous knowledge and experiences with new information, the basic elements and principles underlying the subject to be learned are investigated, logical and critical discussions are made on these elements and principles, and evidence is used, and the learner notices and evaluates the development in the level of comprehension while learning (Entwistle, McCune & Walker, 2001). When students who adopt the surface learning approach study, they adopt a learning approach based on discovering only the "key issues/points" that they deem important. Students using this approach focus on remembering and repeating information beyond the principles, scope and background, purpose and subject area (Curzon, 2004, p.232, Biggs & Tang, 2007). Success and high grades/degrees motivate students with a strategic learning approach. The main reason for these students' approaches is to be successful (Newble & Entwistle, 1986).

Opinions of teacher candidates on learning goals

It is seen that one of the learning goals of biology teacher candidates is the sense of curiosity. In line with this feeling, it is seen that their belief that they can achieve new learning by developing their interests is emphasized. These findings indicate that pre-service teachers have adopted the deep learning approach. Because the deep learning approach is based on curiosity and the strategy arising from this curiosity leads the individual to seek meaning (Ekinci, 2008). People who adopt an in-depth learning approach intend to try to understand the learning material because of its relevance. Beyaztas (2014) also stated in her study that students who adopt the deep learning approach try to search for meaning with a sense of curiosity and a desire to learn in the learning process, and they use pre-organizers. In addition, Beyaztas and Senemoglu (2015) similarly adopted a qualitative method in their study and concluded that individuals with research and inquiry-based expectations tend to have a deep learning approach.

In this study, it was seen that the majority of biology teacher candidates aimed to improve themselves in the learning process. At the same time, pre-service teachers emphasized that if they learned new information, they could improve their proficiency in the fields they were trained in. These findings indicate that pre-service teachers have adopted the deep learning approach. Sankaran and Bui (2001) also found in their study that individuals with high motivation are more inclined to use the deep learning approach. As a matter of fact, one of the basic elements of learning approaches is motivation (Tang, 1994). In-depth learning approach is also based on intrinsic motivation (Ekinci, 2008). This learning approach is part of an intrinsic motivation that arises from the individual's need to perform the task in a meaningful and appropriate way (Biggs, 2001, p. 85, Curzon, 2004, p.232, Biggs & Tang, 2007). The fact that the learning goal is external to get high grades or the need for external motivation to achieve learning will affect the learning approach that the individual will adopt (Coskun, 2006). If students feel the need to know a topic, they automatically focus on the real situations, issues,

principles or successful practices that underlie the meanings. Individuals who adopt in-depth learning approach also tend to understand the learning material for themselves (Yilmaz, 2009).

In Table 1, the pre-service teacher with the code T10 stated that his general purpose in learning is the product of an extrinsic motivation in the theme of strategic learning approach. It can be said that this pre-service teacher uses learning strategies that will enable him to be successful and include the organization, taking into account the evaluation criteria in order to be successful. Individuals who adopt the strategic learning approach have effective effort management. This result is similar to Entwistle's (1995) emphasis on organization in his strategic learning approach.

Opinions of teacher candidates on the purposes of studying for a course exam

It has been observed that biology teacher candidates emphasize learning as a basis in their evaluations regarding the purpose of studying for a course exam and that it is important to fully understand the subject in order to learn. Pre-service teachers emphasized learning by understanding in order to reach accurate and comprehensive information. Pre-service teachers with this approach develop various study strategies in researching the details of the subject area while determining a subject. Ramsden (1991) also revealed in his study that students who adopt an in-depth understanding of learning engage in a search for meaning. Similarly, Senemoglu (2011) stated that students' adopting in-depth learning approach shows that they aim to understand the learning material in depth and show an active participation by showing interest in their studies. In addition, Gijbels and Dochy (2006) concluded in their study that there is a strong and important relationship between students' deep learning approach and higher-order thinking skills. In-depth learning approach is also expressed in the literature as an approach in which the learner investigates the basic elements and principles underlying the subject to be learned, logical and critical discussions are made on these elements and principles, evidence is used, and the learner notices and evaluates the development in the level of comprehension while learning (Entwistle, McCune & Walker, 2001). Byrne, Flood, and Willis (2002) also support our study by interpreting the deep learning approach as a tendency to examine the logic of the subject.

In the study, it is seen that some of the biology teacher candidates emphasize getting high grades. This statement is a product of extrinsic motivation. In other words, it can be stated that high grades motivate these pre-service teachers with a strategic learning approach. Similarly, other researchers have reached conclusions that are in line with these findings. Biggs (1979) states in his study that the strategic learning approach is a learning style that is based on the intention to get high grades and requires employing well-organized effective study methods. The main reason for these students' approaches is to be successful (Newble & Entwistle, 1986). Entwistle (1995) emphasized that the strategic learning approach is an approach that uses one of the superficial and deep

learning approaches, depending on which of the cognitive processes based on understanding the meaning or remembering facts and procedures is emphasized in the perceived evaluation process. Senemoglu (2011) also stated in her study that students with a competitive structure, aiming for high success as a priority, adopt the strategic learning approach. In our study, it was seen that the pre-service teachers who adopted the strategic learning approach acted according to the criteria of the person making the evaluation and determined the learning approach preference accordingly. In another study, Ekinci (2008) stated that students determine their learning approaches by taking their previous exam experiences as a criterion. When the answers of the biology teacher candidates are examined, it is seen that the students use the features of the deep learning approach in order to be successful. In this context, it is seen that pre-service teachers create a basis for meaningful learning, especially in order to be successful and to get high grades. Similarly, Beyaztas (2014) found that students who adopt the strategic learning approach are success-oriented in order to achieve the desired result in the current university exam. The researcher emphasized that these students use the features of deep learning to relieve their anxieties about being in a good position in the future.

Opinions of teacher candidates on the relationship between their past and new learning

It is seen that pre-service biology teachers emphasize that they avoid memorization in their evaluations of the relations they have established between their old learning and their new learning. It is seen that pre-service teachers use pre-organizing knowledge, which creates a structure for new knowledge and allows connection between knowledge, in order to learn by assimilating without memorizing. In addition, in this process, it has been determined that they establish relationships between pre-learning and new learning in order to remember their past knowledge and to realize meaningful learning. Pre-service teachers have beliefs that their previous knowledge is also consolidated in this way. Beyaztas (2014) also reached similar findings in her study by stating that students establish relationships between items and that they learn and remember better when they do so. Again, Byrne, Flood, and Willis (2001) expressed in their study the deep learning approach as a tendency to link previous information with newly learned information, to associate concepts with daily experiences, and to examine the logic of the subject. In addition, MacFarlane, Markwell, Date-Huxtable (2006) express this approach as trying to understand by focusing on applications such as using the newly learned concept in solving a problem, associating it with previous knowledge, and states that it is related to intrinsic motivation. Yilmaz (2009) emphasized in her study that these individuals are involved in active processes such as associating existing knowledge with new information, comparing, setting a framework, testing, and associating with subjects in other disciplines. This result is similar to our study. Similarly, Kahraman (2013) clarified in herstudy that individuals who adopt the deep learning approach also employ higher-level mental processes because they make sense of the subject by associating it with their previous knowledge. In this study, pre-service teachers coded as T7 and T11

presented examples from biology education and stated that the concepts related to the subjects in biology are related to each other. Similar statements were found in the study of Unal and Ergin (2006). Researchers state that deep learning in science education provides the formation of related concepts and relations between these concepts.

Opinions of teacher candidates on their planning while studying

It is seen that pre-service biology teachers progress in a planned way in line with a daily or weekly plan, organize the subjects they will study according to their learning levels, and use learning strategies such as repetition and taking notes that are most suitable for them. In addition, it is stated that they spend extra time and effort when they feel lacking in lessons or subjects. It can be said that pre-service teachers have a desire and aim to be successful in following a learning and working path by focusing on their learning deficiencies. Entwistle (1997, cited in: McLean, 2001) also summarized the strategic learning approach as using time and effort effectively in order to get the highest possible grade in his study. Contrary to the 10 pre-service teachers in planning, organizing and making effort in the theme of strategic learning approach, the pre-service teacher with the code T2 replied "….I usually make instant decisions". Again, the pre-service teacher with the code T11 answered the question by saying "…I cannot make a fixed plan. These candidates emphasized that they did not make a study plan by using statements such as "whenever I make a plan by writing down the hours and the day, I do not implement that plan".

Opinions of teacher candidates on time management while studying

It is seen that biology teacher candidates think that they are deficient in their evaluations of time management while studying. Candidates stated that they planned time consciously according to the subjects. It can be thought that the main reason for this is the desire to be successful. Similarly, Beyaztas (2014) stated in her study that students set goals in order to be successful, and they arrange time and work environment in line with this goal. Entwistle (1995, p.47) also emphasizes this situation and emphasizes that one of the most important features of this approach is organizing in terms of working methods and time management in order to get high grades.

In the strategic learning approach theme, unlike the 9 pre-service teachers in planning, organizing and making an effort, the pre-service teacher with the code T2 said "...I advance my work according to my feelings. I don't necessarily plan a time". Again, the pre-service teacher with the code T11 said, "…I adjust it according to the difficulty of the lesson or my interest in the lesson. I do not work by setting a certain time. I study until I learn the lesson or the subject". The pre-service teacher with the code T8 said, "…I don't set a time for myself to study. If there is a topic that comes to my mind, I will look into it".

When all these statements were examined, it was seen that the pre-service teachers who adopted the deep learning approach stated that one of their learning purposes was a sense of curiosity, that they tried to search for meaning, and that they aimed to improve themselves in the process based on learning. It was seen in the statements of pre-service teachers who adopted the strategic learning approach that they aimed to get high grades. It can be thought that this purpose is in the background of organizing their work and consciously planning their time. In this process, it has been observed that they use learning strategies that will lead them to success. Another result obtained as a result of the content analysis is that the teacher candidates avoid memorization.

The learning approach expresses the aims of individuals while working on the learning object, the basic path they follow and how they organize the learning work (Spencer, 2003). Many studies have been conducted to determine the learning approaches of students at various grade levels and fields in higher education. In the light of these determinations, there are also studies conducted to ensure that students acquire effective learning approaches and learn to learn. It is also possible to find many studies in the literature on determining individual factors, assessment methods and learning strategies that affect learning approaches (Biggs, 1987; Senemoglu, 2011; Richardson, 1995; Selcuk, Caliskan, & Erol, 2007; Ekinci, 2008; Senemoglu, 2011; Scouller, 1998; Biggs, 1979; Kahraman, 2013; Schmeck, 1983; Birenbaum 1997, 2007; Biggs, 2003; Struyven, Dochy, and Janssens, 2005; Watering, Gijbels, Dochy, and Rijt, 2008; Dogan, Atmaca, and Aslan-Yolcu , 2012). When the studies are examined, some of the students use an in-depth process to search for meaning and create meaning while dealing with a learning topic. Some students, on the other hand, try to memorize the subject without making any sense, and consider it sufficient to get the minimum grade required to succeed in the course. Another group of students deals with learning only with the intention of being successful (Ekinci, 2011). In conclusion, based on the findings of this study, it is a pleasing result that there are no pre-service teachers who adopt the surface learning approach. However, it is thought-provoking and sad that there are pre-service teachers who adopt the strategic learning approach with a rate of 83%. In this context, it can be said that the reason for the number of pre-service teachers who adopt the strategic learning approach is the exam factor. The learning approach can be summarized as the perspectives on the concept of learning, which is not a personality trait and changes depending on the intentions of individuals. Ramsden (as cited in Zhang, 2000) stated that one of the important points in learning approaches is not to show continuity. The Oxford Learning Institute (2006, cited in: Yilmaz, 2009) stated that which of the learning approaches will be displayed is a matter of the student's own choice. The student may adopt the in-depth approach for reasons such as the interest of the subject, or may adopt the surface learning approach for reasons such as short time and difficulty of the subject. Students can adopt different learning approaches according to their perceptions in the learning process. When students perceive that the teaching environment has changed,

they can also rearrange their learning approaches (Biggs, 1994). In other words, the same students can apply in-depth, superficial or strategic learning approaches depending on the learning content. Being able to influence and change the learning approach of students is important in terms of teaching process and quality (Ramsden, 1991).

In their longitudinal study, Cope and Staehr (2005) aimed to increase the proportion of students who had a deep learning approach for five years. In the study, the factors preferred by the students who adopt the deep learning approach in the learning environment were determined, and changes were made in the content of the course, the duration of the teaching, the learning tools used, the content of the assignments and the assessment and evaluation methods. According to the findings of the study, when a comparison is made between the first year and the fifth year, a significant increase has been found in the proportion of students who have adopted the deep learning approach. Many findings obtained from other studies in the literature indicate that students' learning approaches and study skills are important factors affecting the quality of learning. Senemoglu et al., (2017) show what kind of learning approaches individuals have in their studies. Researchers also state that guiding students to acquire effective pre-service learning approaches is of great importance. Individuals will either tend to memorize the questions that are likely to be asked to get high grades, or they will turn to research and questioning in order to transform the subject into a knowledge construction of their own. This situation is an important factor that plays a role in students' orientation to the learning approaches they will adopt (Coskun, 2006). Similarly, in this study, the learning approaches of biology teacher candidates were determined, and it was revealed that pre-service teachers, who are the teachers of tomorrow, should adopt learning approaches that will improve their high-level learning skills. At this point, learning approaches are important in order to achieve this. In addition, pre-service teachers, who are the teachers of tomorrow, will be a model for their students to gain effective learning approaches and will also provide their students with effective learning approaches.

5. Conclusions

The main aim of the education is to raise individuals who research, question and adopt a deep learning approach towards learning. Considering this situation, it is important to determine and control the variables that push students/pre-service teachers to their learning approaches. Knowing the differences between individuals' learning approaches will help to find more effective and creative options when planning teaching, and thus to reach more qualified learning outcomes. In the literature, there are studies to determine the individual factors, assessment methods and learning strategies that affect the learning approaches of individuals. At this point, the organization of teaching environments can also be considered as one of the factors that can lead students/pre-

service teachers to deep learning approach. In this context, designing learning environments that include appropriate learning strategies and methods can guide the adoption of the most appropriate learning approach.

References

Algan, E. (2015). *Yükseköğretim Öğrencilerinin Değerlendirme Tercihlerine İlişkin Yapısal Modellerin İncelenmesi: Türkiye ve Amerika Birleşik Devletleri örneği (Investigation of the structural models of higher education students' alternative assessmsent preferences: Sample of Turkey and United States of America*). (Doctoral dissertation) Ankara University Graduate School of Educational Science, Ankara, Turkey.

Belge-Can, H., & Boz, Y. (2012). Yaş ve cinsiyetin ilköğretim öğrencilerinin fen dersini öğrenme yaklaşımlarına etkisi (The effect of age and gender on primary school students' approaches to learning science lessons). X. National Science and Mathematics Education Congress, Niğde, Turkey.

Beyaztas-İlhan, D. (2014). *Başarılı Öğrencilerin Öğrenme Yaklaşımları ve Etkili Öğrenmeye İlişkin Önerileri (Learning approaches of successful students' and their suggestions about effective learning).* (Doctoral dissertation), Hacettepe University Graduate School of Educational Sciences, Ankara, Turkey.

Beyaztas- İlhan, D., & Senemoglu, N. (2015). Başarılı Öğrencilerin Öğrenme Yaklaşımları ve Öğrenme Yaklaşımlarını Etkileyen Faktörler (Learning Approaches of Successful Students and Factors Affecting Their Learning Approaches). *Education and Science, 40*(179), 193-216. http://dx.doi.org/10.15390/EB.2015.4214

Biggs, J. (1979). Individual differences in study processes and the quality of learning outcomes. *Higher Education. 8*, 381-394.

Biggs, J. (1994). Student Learning Research and Theory-where do we currently stand? Improving Student Learning-Theory and Practice. ed. Gibbs. Oxford: Oxford Centre for Staff Development.

Biggs, J. (2001). Enhancing learning: a matter of style or approach?. R.J. Sternberg ve L. F.Zhang (Eds.) Perspective on thinking, learning, and cognitive styles, 73-102. London: Lawrence Erlbaum Associates, Inc.

Biggs, J. & Tang, C. (2007). The Society for research into higher education teaching for quality learning at university. USA: McGraw Hill.

Byrne, M., Flood, B., & Willis, P. (2002). The relationship between learning approaches and learning outcomes: A study of Irish accounting students. Accounting Education, 11(1), 27-42. https://doi.org/10.1080/09639280210153254

Cohen, L., Manion, L. & Morrison, K. (2007). Research methods in education. (6th ed.). London: Routledge Falmer.

Cope, C., & Staehri, L. (2005). Improving students' learning approaches through intervention in an information systems learning environment. Studies in Higher Education, 30(2), 181-197. https://doi.org/10.1080/03075070500043275.

Curzon, L. B. (2004). Teaching in further education an outline of principles and practise. NewYork: Continuum.

Colak, E. (2006). İş birliğine Dayalı Öğretim Tasarımının Öğrencilerin Öğrenme Yaklaşımlarına, Akademik Başarılarına ve Öğrenmenin Kalıcılığına Etkisi. (The effect of cooperative learning

on students' learning approaches, academic performance and learning retention) (Doctoral dissertation), Yıldız Technical University Graduate School of Social Sciences İstanbul, Turkey.

Ekinci, N. (2008). Üniversite öğrencilerinin öğrenme yaklaşımlarının belirlenmesi ve öğretme-öğrenme süreci değişkenleri ile ilişkileri. (Undergraduate students' approaches to learning and their relationships with the variables of teaching-learning process) (Doctoral dissertation), University Graduate School of Social Sciences, Ankara, Turkey.

Ellez, A. M. & Sezgin, G. (2002). Öğretmen Adaylarının Öğrenme Yaklaşımları (Teacher Candidates' Approaches to Learning). V. National Science and Mathematics Education Congress, Ankara, Turkey

Entwistle, N. J. (1995). Frameworks for onderstanding as experienced in essay writing and in preparing for examinations. Educational Psychologist, 30(1), 47-54.

Entwistle, N. (1997). Reconstituting approaches to learning: A response to Webb. Higher Education. 33(2), 213-218.

Entwistle, N. & McCune, V. (2004). The Conceptual Bases of Study Strategy Inventories. *Educational Psychology Review. 16(*4), 325-345.

Entwistle, N., McCune, V., & Walker, P. (2001). Conceptions, styles, and approaches within higher education: analytic abstractions and everyday experience. Sternberg, R.J. & Zhang, L. F. (Eds.). Perspective on thinking, learning, and cognitive styles, 103-136. London: Lawrence Erlbaum Associates, Inc.

Guner-Kahraman, A. (2013). Fen bilgisi öğretmen adaylarının öğrenme yaklaşımlarının durum belirleme tercihleri üzerine etkisinin incelenmesi (Examination of effect on status science teacher canditates' assesstment preference of learning approches). (Master's Thesis), Graduate School of Educational Sciences, Ankara, Turkey.

MacFarlane, Geoff R, Kevin W, Markwell & Elizabeth M Date-Huxtable. (2006). Modelling the Research Process as a Deep Learning Strategy. *Journal of Biological Education, 41*(1), 13-20. https://doi.org/10.1080/00219266.2006.9656051

Miles, M. B. and Huberman, A. M. (1994). An expanded sourcebook qualitative data analysis. London: SAGE Publications.

Newble, D. I. & Entwistle, N. J. (1986). Learning sytles and approaches. implications for medical education. *Medical Education, 20,* 162-175. https://doi.org/10.1111/j.1365-2923.1986.tb01163.x

Ramsden, P. (1991). Learning to Teach in Higher Education. London: Routledge Falmer. books.google.com.

Richardson, J. T. E. (2005). Students' approaches to learning and teachers' approaches to teaching in higher education. *Educational Psychology, 25*(6), 673–680. https://doi.org/10.1080/01443410500344720.

Sankaran, S. R. & Bui, T. (2001). Impact of Learning Strategies and Motivation on Performance: A Study in Web-Based Instruction. Journal of Instructional Psychology, 28(3), 191-198.

Selçuk, Z. (2003). Gelişim ve öğrenme [Development and learning]. Ankara: Nobel Publication.

Selcuk-Sezgin, G., Çalışkan, S. & Erol, M. (2007). Fizik öğretmen adaylarının öğrenme yaklaşımlarının değerlendirilmesi (Evaluation of Learning Approaches for Prospective Physics Teachers'). *Gazi Üniversitesi Eğitim Fakültesi Dergisi, 27*(2), 25-41.

Senemoglu, N. (2011). College of Education Students' Approaches to Learning and Study Skills. *Education and Science, 36*(160), 65.

Senemoglu, N. (2002). Gelişim öğrenme ve öğretim kuramdan uygulamaya [Developing practical learning and teaching theory]. Ankara: Gazi Bookstore.

Spencer, K. 2003. Approaches to Learning and Contemporary Accounting Education. Education in a Changing Environment Conference Proceedings.

Tait, H., Entwistle, N. J., & McCune, V. (1998). ASSIST: a re-conceptualization of the Approaches to Studying Inventory. In C. Rust (Ed.), Improving Students as Learners pp.262-271). Oxford:Oxford Brooks University.

Tavsancıl, E. & Aslan, E. (2001). Sözel, yazılı ve diğer materyaller için içerik analizi ve uygulama örnekleri [Content analysis and application examples for oral, written and other materials]. İstanbul: Epsilon Publication.

Tural-Dincer, G., & Akdeniz, A. R. (2008). Examining learning approaches of science student teachers according to the class level and gender. US-China Education Review, 5(12) 54-59.

Unal, G. & Ergin, Ö. (2006). Buluş yoluyla fen öğretiminin öğrencilerin akademik başarılarına, öğrenme yaklaşımlarına ve tutumlarına etkisi. (The effect of discovery science teaching on students' academic achievement, learning approaches and attitudes) Journal of Turkish Science Education, 3(1), 36-52.

Yildirim A., & Şimşek, H. (2008). Sosyal bilimlerde nitel araştırma yöntemleri [Qualitative research methods in the social sciences]. Ankara: Seçkin Publication.

Yilmaz, M. B. (2009). Karma Öğrenme Ortamındaki Üniversite Öğrencilerinin Öğrenme Yaklaşımlarına Göre Ders Başarılarının, Derse Devamlarının, Web Materyalini Kullanma Davranışlarının ve Ortama Yönelik Memnuniyetlerinin Değerlendirilmesi (Evaluation of university students? academic achievements, attendances, web material using behaviours, and satisfactions with the learning environment according to their learning approaches in a blended learning environment). (Doctoral dissertation), Yıldız Technical University Graduate School Of Social Sciences İstanbul, Turkey

Zhan, L. (2000). University Students' Learning Approaches In Three Cultures: An Investigation of Biggs' 3P Model. Journal of Psychology. 134(1): 37-55. https://doi.org/10.1080/00223980009600847.