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Learning and Studying Approaches as a Predictor of Reflective Thinking Skills towards Problem-Solving of Secondary School Students

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ABSTRACT

In today's rapidly developing technology, individuals are expected to know the ways of accessing information and to have higher order thinking skills. One of these skills is reflective thinking skills. In this study, the relationship between secondary school students' reflective thinking skills towards problem-solving and learning and study approaches was examined. A correlational survey model was used in the research. The sample of the study consists of 633 secondary school students studying in a province located in the Southeastern Anatolia region of Turkey. Within the scope of the research, a questionnaire form was applied to the students to collect the reflective thinking skills for problem solving, the learning and study approach scale, and their personal information. According to the data obtained from the research, it was found that there was a positive and moderate level relationship between students' reflective thinking skills towards problem-solving and their deep and strategic learning and study approaches, whereas a negative and low-level significant relationship was found between surface learning and study approach. In addition, it was concluded that learning and study approaches are a significant predictor of students' reflective thinking skills towards problem-solving and that the dimensions of learning and study approaches explain about 20% of reflective thinking skills towards problem-solving.

Key words: Problem-Solving Skills, Reflective Thinking Skills, Learning and Study Approaches

INTRODUCATION

Introduce the Problem

Research and inquiries, reveals that there is a close relationship between the structuring of knowledge, the way of thinking and the education system (Kemankaşlı, 2010). Today, new developments in knowledge and learning are generally structured within the framework of constructivist theory. This theory is based on the view that knowledge is structured by the individual. This theory is based on the understanding that higher order thinking skills are used to make sense of information. Reflective thinking, which is one of the higher order thinking skills, is at the core of learning and constructivist understanding is more prominent (Murphy, 1998; Baş & Kıvılcım, 2013). The subject of this study is reflective thinking skills, which is one of the higher order thinking skills.

Reflective thinking is a decision-making process that explains the experiences of an individual and the results of these experiences (Rodgers, 2002). However, studies reveal that reflective thinking has an important effect on students' problem-solving skills (Shermis, 1992; Kızılkaya & Aşkar, 2009). In this context, reflective thinking has become an important research subject in many different disciplines, especially educational sciences (Adadan & Öner, 2018; Akpur, 2020; Antonio, 2020; Erdoğan, 2020; Martyaningrum & Prabawanto, 2020; Rabu & Badlishah, 2020; Yılmaz, 2020). Reflective thinking is the logical and informed decision-making process that involves the evaluation of results (Taggart & Wilson, 2005). Accordingly, individuals with reflective thinking skills can transfer the problems they encounter and the information they learn to different situations (Duban & Yelken, 2010). In this context, it is very important to reveal the factors that can be effective in the development of students' reflective thinking skills for problem-solving in learning environments and to examine the relationships between them, in terms of contributing to the literature.

Reflective thinking is defined as the active, permanent, and careful evaluation of a belief or form of knowledge in the light of the reasons and tendencies supporting it (Dewey, 1933). Reflective thinking is a decision-making process and it is the formation of new thoughts from the knowledge and thoughts of the individual (Mezirow, 1991). According to Dewey (1933), reflective thinking highlights the consequences of ideas and suggests future physical actions to face and resolve various personal and professional obstacles. Mezirow (1977, 1991, 1998) stated that reflective

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thinking takes place in four stages. These are habitual action, understanding, reflection, and critical thinking. Habitual action is a mechanical and automatic action performed with very little conscious thought. Understanding is learning and reading without relating to other situations. Reflection is the active, permanent, and careful evaluation of assumptions or beliefs in consciousness. Finally, critical reflection (thinking) is considered to be a higher level of reflective thinking that involves a better understanding, awareness of why we perceive things and how we feel, move and do (Leung & Kember, 2003).

Reflective thinking skills have a very important place in students' becoming individuals with 21-century skills. In the literature, it is seen that there are many studies about the importance of the reflective thinking skills of teachers and teacher candidates in the context of teaching and learning (Grushka et al., 2005; Harrison et al., 2005; Pedro, 2005). Accordingly, it is stated that reflective thinking is a cognitive awareness that enables to establish a relationship between the past, present, and future, puts forth facts, suggestions, and theories to solve complex problems, and contributes to the development of students' learning experiences (Demirci, 2020; King & Kitchener, 1994; Schön, 1983).

However, it is stated that reflective thinking is beneficial as it enables both students and educators to think critically about their learning and professional development (Grushka et al., 2005; Leung & Kember, 2003; Phan, 2009; Yanchar et al., 2008). Accordingly, reflective thinking is the development of skills that can help individuals to be critical and develop expertise in the fields of professionalism. According to Mezirow (1977, 1991, 1998), reflective thinking is an important source of information in students' learning processes.

Another factor that is effective in students' learning processes is their learning approach. The learning approach is defined as the way students handle their working and learning processes. According to Ramsden (1987), the learning approach is the way a student organizes a learning activity. In other words, it is a way of explaining the student's reaction to a learning task, and this may change from time to time (Biggs, 1993; Rowe & Harris, 2000). Learning approaches express the relationship between students' intentions, motives, and learning strategies (Diseth, 2002).

The concept of learning approaches SAL (Student Approaches to Learning) is based on the experimental work of Marton and Säljö (1976). One of the most cited sources in the entire educational psychology literature, this pioneering study introduced two main categories of approaches to learning: the "surface" and the "deep" approaches (Marton & Säljö, 1976). In the surface learning approach, the student gets into the business of bending the text itself to reproduce it without further analysis. On the contrary, students who adopt a deep learning approach direct their attention to understanding and relating it to previous knowledge and personal experiences (Murphy & Tyler, 2005). In summary, the discourse in the deep approach is oriented towards comprehension, in contrast to the reproduction of the learning understanding shown in the surface approach (Amidu, 2012).

Entwistle and Richardson (1983) proposed a "strategic approach" other than the surface and deep learning in their study. The strategic approach is based on achieving motivation and includes strategies that lead to high scores (such as good organization, effective note-taking, marking scheme, and awareness of the criteria). Accordingly, three approaches (surface, deep and strategic) are defined depending on the level at which the information is processed. These three approaches are associated with different learning motivations and strategies (Biggs & Watkins, 1995).

Surface Approach: It is the way the student copes and engages with the task (Biggs, 1987). Students with a surface approach focus on facts, emphasize the reproduction of basic knowledge and rely on extrinsic motivations (Beckwith, 1991). On the other hand, students using the surface approach report extrinsic motivation and tend to meet the minimum study requirements. In addition, they fear failure (Duff & McKinstry, 2007) and use memory skills as the basis of their learning (Freiberg Hoffmann & Fernández Liporace, 2016) to perform their tasks with the least effort (Monroy & Hernández Pina, 2014). The surface approach is based on extrinsic motivation (Bigs, 1991). Factors that encourage students to adopt a surface approach to learning are insufficient time, too much workload, and high anxiety (Biggs & Tang, 2011).

Deep Approach: Current studies show that this approach is a characteristic of creative students; that it engages in autonomous and critical thinking, understanding knowledge well (Duff & McKinstry, 2007; Warburton, 2003), expression skills, clarity of ideas (Chin & Brown, 2000; Ojala, 2013) and successful learning with intrinsic motivation (Leal Filho et al., 2018). According to Biggs (1988), students who use a deep approach exhibit high intrinsic motivation. In-depth learning is a fundamental strategy in which students gain meaning and understanding from course materials and experiences (Warburton, 2003). The deep approach stems from the need to perform the task appropriately and meaningfully, so the student tries to use the most appropriate cognitive activities to tackle the task. When students feel this need, they automatically try to focus on basic meanings, main ideas, themes, principles, or successful practices (Biggs & Tang, 2011). When people have learned deeply, they know when, how, and why to apply one's knowledge and skills (Bogard et al., 2018). The deeply literate student takes responsibility for their own learning. The deeply literate student looks beyond, the deep student looks over, under and around what they are learning. The deeply literate student strives to truly connect, to analyse and understand - in context, with an open and simultaneously critical perspective.

Strategic (Success) Approach: This approach refers to the intention to succeed and to achieve the best possible grades through the organization of time and learning environment (Diseth, 2002). Strategically motivated students try to gain social recognition through academic results (Biggs & Watkins, 1995).

This strategy, as it is surface and deep, is about managing the context of learning, not addressing its content: It is about organizing time, the field of study, and curriculum scope in

the most cost-effective way (study skills). A student who adopts this approach plans ahead is orderly and systematic and devotes time to tasks in proportion to their potential to gain marks (Biggs, 1991).

However, when the literature on the subject is examined, it is seen that learning approaches differ statistically significantly according to the high school type variable (Kartal & Yazıcı, 2020), that it is a significant predictor of academic success (Bahar & Okur, 2018), and anxiety level (Oğuz & Karakuş, 2017), and internal-external locus of control (Olpak & Korucu, 2014). However, it is stated that there is a high level of reflective thinking skills in secondary school students (Köseoğlu et al., 2017), a significant relationship with self-management skills (Aldan-Karademir & Görgün, 2019), mathematics and geometry (Baş & Kıvılcım, 2013) and significantly predict academic achievement in science and technology courses (Baş, 2013).

In today's rapidly developing technology, individuals are expected to know the ways of accessing information and to have higher order thinking skills. One of these skills is reflective thinking skills. Reflective thinking is explained as a kind of special problem-solving method in which thoughts are organized by connecting each thought to the previous thought in order to find a solution to a subject (Hatton & Smith, 1995). An individual who can think reflectively can make connections between past, present, and predicted ideas for the future, question herself, and evaluate herself and events (Wilson & Jan, 1993). Reflective thinking requires the individual to consider learning goals and methods, and the actions and ideas of one's own and other people. When the literature is examined, it is seen that on the one hand, studies on explaining reflective thinking skills and on the other hand, on determining the variables that may be related to these skills. It can be stated that one of these variables is learning approaches. Learning approaches defined as students' relationship with learning are classified as deep, surface, and strategic (Kızılkaya & Aşkar, 2009). At this stage, it is thought that revealing the relationship between deep, surface, and strategic learning approaches and students' reflective thinking skills for problem-solving will contribute to the literature. When the literature on reflective thinking skills is examined, it is noteworthy that there is a consensus that these skills are a skill that can be developed. However, this process is difficult and needs to be supported. At this point, it is important to reveal the role of students' learning and study approaches.

Purpose of the Research

This study, it was aimed to reveal the predictive status of learning and study approaches of secondary school students' reflective thinking skills towards problem-solving. For this purpose, the following questions were posed:

1. What level are secondary school students' approaches to learning?
2. What level are secondary school students' reflective thinking skills towards problem-solving?
3. Is there a relationship between secondary school students' learning and studying approaches and their reflective thinking skills towards problem-solving
4. Are secondary school students' learning and studying approaches significant predictors of their reflective thinking skills towards problem-solving skills?

METHOD

Research Model

The research was carried out according to a correlational survey model, which is one of the quantitative research approaches. A correlational survey model is used in studies conducted to determine whether there is a change between two or more two variables (Karasar, 2012).

Research Group

The study group of the research consists of secondary school students in the provincial center of a province in the Southeastern Anatolia region of Turkey. Since it is difficult to reach the entire population (due to time and economic reasons), the study was conducted on the sample representing the population. In this context, it is stated that it is sufficient to have a sample of 370-378, which can represent the population in the range of 10,000-25,000 with 5% error (Yazıcıoğlu & Erdoğan, 2004). Accordingly, the sample of the study consists of 633 secondary school students studying at secondary school selected using the simple random sampling method. When the data set obtained in the study is examined, 53.6% (339) of secondary school students are females and 46.4% (294) are males. It was determined that 22.4% (142) of the students were 5th grade, 22.4% (142) were 6th grade, 27.2% (172) were 7th grade and 28% (177) were 8th grade.

Data Collection Tools

Learning and Studying Approaches Inventory; the inventory used to measure the learning and study approaches of secondary school students participating in the study was developed by Hounsell et al. (2002) and its validity and reliability study was carried out and adapted to Turkish by Topkaya et al. (2011). The inventory consists of 18 items and five sub-dimensions (surface learning, deep learning, monitoring studying, effort management, and organized studying). Among the sub-dimensions of the inventory, surface learning consists of the surface approach; deep learning and monitoring studying, deep approach; effort management, and organized studying, the strategic approach. The inventory was graded in a five-point Likert type and was scored as "completely suitable (5)", "somewhat suitable (4)", "undecided (3)", "not very suitable (2)" and "not at all suitable (1)". The factor loads of the inventory, which was adapted to Turkish, were between .27 and .82, the fit indexes of the confirmatory factor analysis were determined as χ^2= 31.64, SD= 13, p= 0.002, GFI= 0.99, AGFI= 0.97, SRMR= 0.03, CFI= 0.95, RMSEA= 0.04 and the Cronbach alpha internal reliability coefficient was determined as .88. In the study, the Cronbach alpha internal reliability coefficient of the learning and study approaches inventory was determined as .76. The high score obtained from each learning approach dimension indicates

that the individual prefers to use that learning approach more, and the low score indicates that she/he prefers to use that learning approach less.

Reflective Thinking Skills for Problem Solving; the "Reflective Thinking Skills Scale for Problem Solving" developed by Kızılkaya and Aşkar (2009) was used to measure secondary school students' reflective thinking skills. The scale consists of 14 items and 3 dimensions (inquiry, reasoning, and evaluation). The scale is in five-point Likert type and is scored as "always (5)", "often (4)", "sometimes (3)", "rarely (2)", "never (1)". Confirmatory factor analysis fit indices were reported as GFI=0.92, AGFI=0.89, NNFI=0.93, CFI=0.95, RMSR=0.08, RMSEA=0.071 in the validity and reliability studies of the scale (Kızılkaya & Aşkar, 2009). The Cronbach alpha internal reliability coefficient of the original scale developed was .83, and the Cronbach alpha internal reliability coefficient values of the scale were determined as .78 in our study. However, the high or low score obtained from the reflective thinking skills scale for problem-solving is interpreted as high or low secondary school students' reflective thinking skills.

Data Collection Process

Before the data collection process, necessary permissions were obtained from the relevant academic staff for the use of data collection tools. Then, data were collected under the supervision of school administrators working in the secondary schools where the study was conducted. During the data collection process, the scales were filled in by the students in about 20 minutes. The completed scales were examined one by one, and forms that were marked more than one or incompletely and that were not physically readable were not included in the evaluation. The data of 633 students were digitized and the data analysis phase was started.

Data Analysis

In the data analysis phase, it was evaluated whether the data set provided the assumption of normality. For this purpose, kurtosis-skewness values and Q-Q plots were examined. Accordingly, it was determined that the values of reflective thinking skills (-.30 to .54) and learning and studying approaches (-.65 to .80) for problem-solving were within normal limits. In the literature, it is stated that the kurtosis-skewness value between -2 and +2 shows a normal distribution (Kalaycı, 2014). Again, it was observed that the data supported the assumption of normality in the form of an ellipse around the line with an angle of 45 degrees in the Q-Q graph (Figures 1a and 1b).

The interpretation of the arithmetic mean of the variables in the study was carried out according to the lower and upper limits, based on the assumption that the intervals in the data collection tool are equal. Accordingly, the limits of the options in the data collection tool are presented in Table 1.

As can be seen in Table 1, in the interpretation of the arithmetic mean of the data, the range of 1.00-2.59 is accepted as "insufficient level", 2.60-3.39 as "medium level", 4.20-5.00 interval is accepted as "adequate". Pearson Product-Moment Correlation Coefficient (r) was used to examine the relationship between variables. The values determined by Büyüköztürk (2010) were used to interpret the correlation coefficient. According to this, values of 0.00-0.30 are considered to indicate a "low level", values of 0.30-0.70 "moderate" and values of 0.70-1.00 "high level" relationship. In addition, the regression analysis method was used in predicting the dependent variable of the independent variables. Beta (β) coefficient and t-test result were taken into account in the interpretation of the regression analysis. In the analysis of all data, the significance value of $p < .05$ was taken as a basis.

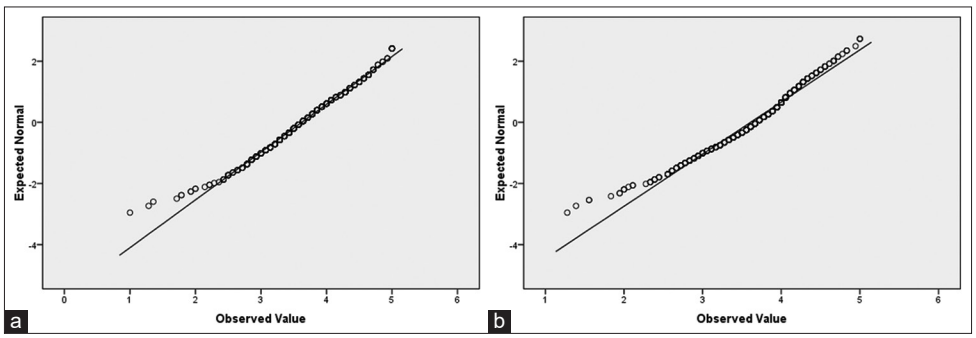

Figure 1. (a) Reflective thinking skills for problem solving. (b) Learning and studying approaches

Table 1. Arithmetic mean limits for data collection tools

Options		Point value	Ranges	Levels	Options
Always	Completely suitable	5	4.20-5.00	3.40-5.00	Adequate Level
Often	Somewhat suitable	4	3.40-4.19		
Sometimes	Undecided	3	2.60-3.39	2.60-3.39	Medium Level
Rarely	Not very suitable	2	1.80-2.59	1.00-2.59	Insufficient Level
Never	Not at all suitable	1	1.00-1.79		

RESULTS

The study aims to reveal the predictive status of secondary school students learning and studying approaches to their reflective thinking skills towards problem-solving. Accordingly, the findings obtained depending on the research questions are presented in Table 2.

When Table 2 is examined, it was determined that the reflective thinking skills of secondary school students for problem-solving were at an adequate level with arithmetic mean score of 3.62. However, when the arithmetic mean scores of the students regarding their learning and study approaches were examined, it was determined that the arithmetic mean score of the surface approach was 2.83, the arithmetic means a score of the deep approach was 3.83, and the strategic approach was 3.82. Accordingly, it has been determined that the surface approach is at a medium level, and the deep approach and strategic approach are at a adequate level for secondary school students. Another finding obtained in the study is the relationship between the learning and studying approaches of secondary school students and their reflective thinking skills for problem-solving. Accordingly, it was determined that there is a moderately significant positive relationship between the reflective thinking skills of secondary school students and their deep approach (r=.42; p<.01) and strategic approach (r=.33 p<.01) to problem-solving. On the other hand, it was determined that there is a low level of a significant relationship in the negative direction between the surface approaches of secondary school students and their reflective thinking skills towards problem-solving (r = -. 09; p <.05).

When Table 3 is examined, as a result of the simple linear regression analysis, it has been determined that the surface approach is a significant predictor of secondary school students' reflective thinking skills for problem-solving. However, it was determined that there is a significant negative relationship (t_{660}= -2.416, p=.016) exists between the students' surface approach and their reflective thinking skills for problem-solving indicating that one standard deviation increase in the surface approach is related to .096 standard deviation decrease in reflective thinking skills. Also, the surface approach of the students explains about 0.9% of the total variance on their reflective thinking skills for problem-solving.

In Table 4, the results of multiple linear regression analysis determined whether the scores of the surface and deep approaches are a significant predictor of the reflective thinking skills for problem-solving are presented. Accordingly, the regression model established with the findings of the one-way ANOVA test was found to be significant (F=73.958, p<.01). As a result of the regression analysis, it was determined that the surface approach (t_{659}= -3.095, p= .002) and the deep approach (t_{659}=11.865, p<.001) were significant predictors of students' reflective thinking skills for problem-solving (R=.436, R^2=0.19). Controlling for deep approach, one standard deviation increase in surface approach is associated with .111 standard deviation decrease in reflecting thinking skills for problem-solving. Controlling for surface approach, one standard deviation increase in deep approach is associated with .426 standard deviation increase in reflecting thinking skills for problem-solving. It was determined that surface approach and deep approach explain 19% of the total variance in reflecting thinking skills for problem-solving. However, it can be said that the deep approach predicts students' reflective thinking skills towards problem-solving more than the surface approach.

The MLR results (Table 5) indicate whether the surface, deep and strategic approach scores are significant predictors of reflective thinking skills for problem-solving. The ANOVA results show that the established regression model is significant (F= 52.812, p<.01). The result of the regression analysis showed that the surface approach (t_{658}=-3.281, p=.001), deep approach (t_{658}=7.850, p<.001), and strategic approach (t_{658}= 2.951, p=.003) significantly predicted students' reflective thinking skills for problem-solving (R=.449, R^2=.201). Controlling for deep approach and strategic approach, one standard deviation increase in surface approach is associated with .117 standard deviation decrease in reflecting thinking skills for problem-solving. Controlling for strategic approach and surface approach, one standard deviation increase in deep approach is associated with .348 standard deviation increase in reflecting thinking skills for problem-solving. Finally, controlling for deep approach and surface approach, one standard deviation increase in strategic approach is associated with .131 standard deviation increase in reflecting thinking skills for problem-solving. However, while the surface approach of students negatively predicted their reflective thinking skills towards problem-solving, the deep and strategic approaches were positive predictors. Surface, deep, and strategic approaches explain around 20% of the total variance of reflective thinking skills of students for problem-solving. The deep learning approach predicted students' reflective thinking skills towards problem-solving the best, followed by a strategic and surface approach.

DISCUSSION

Teaching and learning processes are influenced by different cognitive variables such as student learning approaches and reflective thinking. In this study, the results and suggestions obtained from the study on determining the status of learning and studying approaches to predict secondary school students' reflective thinking skills towards problem-solving are presented below.

Secondary school students' reflective thinking skills for problem-solving were found to be at an adequate level with arithmetic mean score of 3.62. Reflective thinking enables students to be responsible for their learning, track their individual development, and evaluate themselves.

Table 2. Arithmetic mean standard deviation and correlation analysis findings for variables

	Variables and sub-dimensions	X	SS	1†	2	3	4
1	Reflective thinking skills	3.62	0.63	1	-0.09*	0.42**	0.33**
2	Surface approach	2.83	0.90		1	0.03	0.06
3	Deep approach	3.83	0.72			1	0.59**
4	Strategic approach	3.82	0.86				1

†1. Reflective thinking skills, 2. Surface approach, 3. Deep approach, 4. Strategic approach
**p<.05, ** p< .01

Table 3. Simple linear regression analysis findings between reflective thinking skills and surface approaches to problem-solving

Variable	B	SH_B	*β*	*t*	*p*
Constant	3.814	0.084		45.648***	.000
Surface approach	-0.068	0.028	-0.096	-2.416*	.016

R=.096, R^2=.009, F= 5.837; *p<.05, **p<.01, ***p<.001

Table 4. Multiple regression analysis findings between reflective thinking skills for problem-solving and surface and deep learning approaches

Variable	B	SH_B	*β*	*t*	*p*
Constant	2.408	0.141		17.124***	.000
Surface approach	-0.079	0.025	-0.111	-3.095**	.002
Deep approach	0.375	0.032	0.426	11.865***	.000

R=.436, R^2=.190, F= 73.958; *p<.05, **p<.01, ***p<.001

Table 5. Multiple regression analysis findings between reflective thinking skills for problem-solving and surface, deep and strategic learning approaches

Variable	B	SHB	*β*	*t*	*p*
Constant	2.313	0.143		16.136***	.000
Surface approach	-0.083	0.025	-0.117	-3.281**	.001
Deep approach	0.307	0.039	0.348	7.850***	.000
Strategic approach	0.097	0.033	0.131	2.951**	.003

R=.449, R^2=.201, F= 52.812, *p<.05, **p<.01, ***p<.001

Student-centered education based on constructivism aims to develop reflective thinking skills. In this study, the adequate level of reflective thinking skills of secondary school students can be interpreted as an indicator that the program has reached its goals. In the study of Aldan-Karademir and Görgün (2019), secondary school students' reflective thinking skills for problem-solving are above the median value. Köseoğlu et al. (2017) concluded that 7th-grade students have high reflective thinking skills for problem-solving. Contrary to these studies, Erdoğan (2019) found that secondary school students' reflective thinking skills for problem-solving are at a low level. It can be said that the reason why secondary school students' reflective thinking skills appear at different levels is related to the teaching method, the learning environment, and the degree to which the teacher has reflective thinking skills. Reflective thinking is a skill that can be developed using various methods (Wilson & Jan, 1993). These methods are learning articles, learning diaries, reflective journals, self-evaluation, questioning, mind mapping, concept maps, and product selection files. Teachers can use these methods to improve their students' reflective skills. However, it is important for a teacher who wants to develop students' reflective thinking skills to have this skill first. Because teachers with reflective thinking skills support and guide students (Wilson & Jan, 1993).

In the study, it was determined that the surface learning approaches are at a medium level, while the deep approach and strategic approach are at an adequate level. It can be said that the secondary school curriculum, which was prepared with an understanding based on constructivism, prompted students to prefer a deep learning approach, thus enabling students to develop their high-level thinking skills and to absorb and internalize the subject. In the study of Özdemir and İlhan-Beyaztaş (2018), it is seen that students generally adopt surface and in-deep learning approaches. In Yağcı's (2015) study, it was determined that the majority (78.5%) of the pre-service teachers of the Computer Education and Instructional Technologies department preferred the deep study approach and a small portion (21.5%) preferred the surface study approach.

It has been determined that there is a moderately significant positive relationship between secondary school students' reflective thinking skills towards problem-solving and students' deep approach and strategic approach. In this case, it can be said that if the deep and strategic approach increases, the reflective thinking skills of the students towards problem-solving tend to increase. Students with reflective thinking skills can set their own learning goals and take responsibility for their own learning, in which case the student can achieve their goals using a deep or strategic approach. It was concluded that there is a low level of a significant relationship in the negative direction between the students' reflective thinking skills and their surface approach to problem-solving. In the study, it was concluded that there was a low level of a negative relationship between the students' reflective thinking skills and their surface approach to problem-solving. In this case, it can be stated that increasing the surface approach decreases the reflective thinking skills of the students. This situation is quite striking. Similar to this finding, Leung and Kember (2003) found that understanding, thinking, and critical thinking were related to the deep approach, but not to the surface approach in their research, where they examined the relationship between students' learning approaches and reflective thinking stages. Understanding, thinking, and critical thinking correspond to the use of a deep approach in which significant levels of personal assimilation are increased. These findings provide evidence of the close relationship between learning approaches and stages of reflection on practice. Previous studies have supported the relationship between approaches to learning and academic achievement (Diseth & Martinsen, 2003); high achievement is typically predicted by deep and/or strategic approaches, and low achievement is predicted by a surface approach to learning (Diseth, 2002). Ekinci (2008) also found a significant positive relationship between students' achievement levels and their deep and strategic approach to learning, and a significant negative relationship between their surface approach to learning. Therefore, as the success level of the student's decreases, their surface approach to learning scores increases significantly.

In the study, it was determined that the surface approach is a significant predictor of secondary school students' reflective thinking skills towards problem-solving. It has been

determined that there is a low-level significant negative relationship between students' reflective thinking skills and their surface approach to problem-solving. In addition, it can be said that 0.9% of the total variance regarding reflective thinking skills for problem-solving can be explained by students' surface approaches. Bayrak and Koçak-Usluel (2011) found that reflective thinking skill is a predictor of deep learning approach. Reflective thinking encourages deeper learning. For this reason, secondary school students should avoid the surface learning approach and adopt the deep learning approach to gain problem-solving, critical thinking, information literacy, and high-level thinking skills. Since the use of the deep learning approach encourages students to use high-level thinking skills, explore the relationships between parts, take active participation in the learning process, and take advantage of research skills in learning activities, it can be said that the reflective thinking skills of students who prefer the deep learning approach will also increase.

It was concluded that secondary school students' surface and deep approaches together were associated with their reflective thinking skills for problem-solving. These variables together explain 19% of reflective thinking skills for problem-solving. It was determined that these two predictor variables are the deep approach and surface approach in order of importance on students' reflective thinking skills towards problem-solving. However, it was found that the deep approach predicted the reflective thinking skills positively and the surface approach significantly predicted the reflective thinking skills negatively. In the study of Amidu (2012), it was determined that the deep learning approach was significantly and positively related to the reflective thinking skill, while the surface approach was negatively related to the reflective thinking skill. The deep learning approach is associated with constructivist teaching. The surface approach, on the other hand, is related to the traditional transfer teaching model in which students assume passive roles. Hence, deep learning develops reflective thinking skills as a result of the constructivist learning environment. The surface approach does not support the development of reflective thinking skills of the traditional learning environment, because the student is not active and does not have a say in this environment, and is not responsible for her/his learning and development.

Finally, it was concluded that students' surface, deep and strategic approaches were associated with their reflective thinking skills for problem-solving together. These three variables together explain about 20% of reflective thinking skills for problem-solving. The order of importance of these three predictor variables on students' reflective thinking skills towards problem-solving is deep approach, strategic approach, and surface approach. Similar to this finding, in Demir and Kösterelioğlu's (2020) study, pre-service teachers preferred the deepest, later strategic, and least surface learning approach. However, it was determined that the deep and strategic approach predicted the reflective thinking skills towards problem-solving positively, and the surface approach significantly predicted it negatively. Because, in surface learning, the student will negatively affect reflective thinking skills as they do not internalize (absorb) knowledge and meaning (Biggs & Watkins, 1995). Deep learning positively affects reflective thinking skills as it involves a higher level of abstraction and processing where the student tries to understand the meaning of what he or she has learned (Biggs & Watkins, 1995).

CONCLUSION

Based on these results, the following suggestions can be made:

In-service training courses and conferences can be organized to teach teachers the necessary methods to develop their students' reflective thinking skills. Because the effective lecturer takes the students to the higher cognitive level, from surface learning to deep learning.

Since students can be more successful in the academic field, to be information literate by gaining the habit of studying effectively and efficiently, a course that can provide students with the habits of "effective learning and studying" can be included in the curriculum.

Since it is important in terms of determining students' learning approaches, learning more effectively, and helping teachers who want to monitor and improve the effectiveness of their teaching, inventories that reveal students' learning and study approaches should be applied at the beginning of the academic year. In-service training should be provided to teachers, which includes the purposes of applying this inventory, how to evaluate the results of the inventory and how to reflect it on the education and training environment. The results of the inventory should also be shared with the students, and they should be given feedback and information on this issue. Thus, a student who adopts a surface learning or strategic learning approach will be more conscious of what to do for deep learning.

To investigate the effectiveness of learning and study approaches, emphasis should be placed on experimental research. In these experimental studies, qualitative data should be used as well as quantitative data. Thus, information can be obtained about the situations in which the student adopts the approach and how consciously she/he does it.

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