

Full Length Research Paper

The effect of phenomenon-based learning approach on students' metacognitive awareness

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This study aims to determine the effect of learning activities conducted in accordance with the phenomenon-based learning approach on the metacognitive awareness level of students. Pre-test and post-test control group design of the experimental method was used. The application of the study was carried out in a sample of 60 students studying in the 7th grade of middle school in the 2019-2020 academic year. While "phenomenon-based learning approach" was implemented in the experimental group, traditional teaching was used in the control group. In this research, as data collection tool "metacognitive awareness" scale was used. The scores of the experimental and control groups obtained from the scale were compared to the dependent groups with the t-test, and when there was a significant difference between the students' pre-test scores and post-test scores, the effect size of the difference was found by looking at the Cohen's d value. In addition, when the pre-test scores of the students in the experimental group and the control group were taken under control, covariance analysis was conducted to determine whether there was a significant difference according to the post-test scores. According to the indications obtained at the end of the research teaching activities conducted in accordance with the phenomenon-based learning approach provided significant differences in the metacognitive awareness levels of the students in favor of the experimental group.

Key words: Phenomenon-based learning, metacognition, metacognitive awareness.

INTRODUCTION

Recently, there is a rapid increase in knowledge. Students need to get the information that will be useful among many to meet their needs. In the process of responding to their needs, it is also important to know the most accurate information, how, when and where it should be used. In this case, the students should be able to control and manage their own cognition structure by

questioning themselves about what they know or not. This is important for the metacognitive concept.

Flavell (1976), who was the first researcher to use the concept of metacognition in the field of education defines it as "It is individuals' cognitive processes, learning outcomes or knowledge about themselves." Boekaerts (1997) defines metacognition as the processes that

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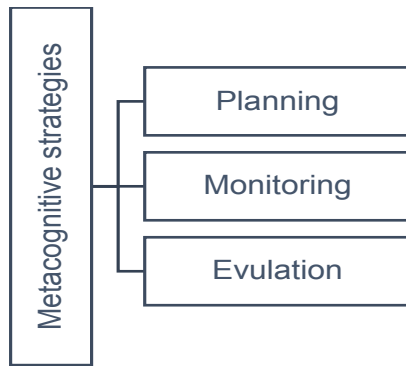


Figure 1. Metacognition strategies.

regulate individuals' own cognitive activities and cognitive strategies, Winne and Perry (2000) define it as the awareness of students' academic strengths and weaknesses.

Metacognition is individuals thinking about their own learning and making an assessment of what they know. In this evaluation, it is important to understand information correctly and to infer which information should be used (Taylor, 1999). Metacognition consists of three strategies (Zimmerman, 1989; Zimmerman and Poulsen, 1995; Schraw and Moshman, 1995; Pintrich, 1999; Schunk, 2009; Throndsen, 2011): planning, monitoring and regulation strategies.

Figure 1 shows that metacognitive strategies are metacognitive activities that help a student to control his or her own learning and thinking (Schraw and Moshman, 1995). In other words, it refers to the dynamic aspects of turning information into action.

1. Planning: It is a process of planning to solve a problem or completing a task, selecting and organizing relevant materials. In the planning strategy, students are expected to set goals, analyze tasks, select appropriate materials and make arrangements.

2. Monitoring: It is a cognitive process where the realization of the objectives is reviewed; self-evaluations guiding for future studies are made, and feedback is given. In the monitoring strategy, students are expected to distinguish between their effective and ineffective performances and to choose the necessary and appropriate strategies.

3. Evaluation: It is the assesment of students' own learning process, compliance with cognitive activities and its outcome. At the same time, it is the decision an individual made about the usefulness of the learning products and the strategies used in the learning process. In the evaluation strategy, students are expected to re-evaluate their learning goals, revise and correct their predictions, and reinforce their intellectual achievements and acquisition.

It is known that metacognitive strategies that enable

students to question and evaluate what they know, what they want to know and what they can do, provide students with awareness of their own learning, and also provide learner-centered information (Darling et al., 2003). Metacognition is a thinking system. Student is an active participant who has a say in learning by interacting with the external environment in the learning process. In this process, what makes the student active is being aware of his or her own cognition.

Metacognitive awareness is defined as a clear awareness of the strategies employed to control, organize and plan understanding (Grabe and Stoller, 2002). As metacognitive awareness gives individuals the opportunity to plan, explore and monitor learning it directly affects performance development (Schraw and Dennison, 1994). Therefore, metacognitive awareness is vital for cognitive effectiveness (Gourgey, 1998). In addition, metacognitive awareness refers to the conscious control of students' knowledge, learning processes, affective and cognitive states, and students' regulation (Papaleontiou-Louca, 2003; Garcia et al., 2016). Thanks to this awareness, they can reflect and monitor their cognitive activities. Moreover, being aware of their mental activities, they also have the opportunity to use the right strategies to meet the needs at the point of reviewing and organizing the activities. When evaluated in this respect, it is understood that it is important to improve students' metacognitive awareness.

It is thought that one of the innovations to increase students' metacognitive awareness is phenomenon-based learning approach. The phenomenon-based learning approach is defined as a student-led, multidisciplinary model based on inquiry and problem solving skills. The phenomenon-based learning approach is an education movement launched in Finland in 2016. Instead of passive learning approaches, it seeks to expand students into learning experiences that apply knowledge and skills from multiple disciplines while further deepening them into environmental situations that are compatible with real-life problems.

While exploring observable phenomena and developing evidence-based knowledge to help explain and predict the phenomenon, students develop key skills such as communication, critical thinking, problem solving, and teamwork (Fields and Kennedy, 2020).

Silander (2015) states that the phenomenon-based learning approach consists of five dimensions (holisticity, authenticity, contextuality, problem-based inquiry learning, open-ended learning processes). These are:

1. The holisticity dimension refers to the diverse discipline of phenomenon-based learning that is not integrated into traditional school lessons, but rather focuses on a systematic, comprehensive review of current events in the real world.

2. Authenticity dimension refers to the use of methods, tools and materials necessary for students to solve

problems that are important both in their lives and in society. While the theory and knowledge have immediate benefit, experts and professionals from many different fields are included in learning activities and students are encouraged to take part in real expert culture and practice. Classroom environments are considered to be a real and authentic learning environment rather than a traditional classroom.

3. The contextuality dimension is considered as a meaningful and systemic learning of the phenomenon in a natural environment.

4. Problem-based inquiry dimension, students develop hypotheses and theories of work. In the learning process, they ask their own questions and create information collaboratively.

5. Open-ended learning processes, students plan their learning process themselves by creating their own learning tasks and tools and they make an effort for learning. The aim is to make it easier for students to learn something new.

The student is in the center of phenomenon-based learning. The student is free to start learning about a topic of his or her interest (Symeonidis and Schwaz, 2016). No subject is taught in lessons where this approach is used, and there is no predetermined learning goal. Instead, students investigate and solve their own questions by applying them in problem-related lessons (Bobrowsky et al., 2014).

In the lessons where the phenomenon-based learning approach is used, students contribute and learn from the subject as active participants (Raahan, 2016). In this approach, the student does not readily learn the knowledge and skills in advance. Knowledge and skills are acquired as a result of a more meaningful learning experience by actively engaging the student in the problem-solving process in a real world context. In this process, the student discovers knowledge and skills by himself or herself. (Zhukov, 2015). The most important aim of the phenomenon-based learning approach is deep learning and understanding. It is aimed for students to study in depth on a subject they are curious about, in cooperation with different ways and perspectives (Silander, 2015). In addition the phenomenon-based learning approach always gives students a new learning experience. It supports self-perception, interpretation, interpretation with action and understands what has been learned. Learning by this way becomes a meaningful and effective activity for the student. (Kivelö, 2015).

The purpose of the phenomenon-based learning approach is to provide students with a life experience to provide learning opportunities that will increase their desire to study (Zhukov, 2015). These features of the phenomenon-based learning approach emphasize the necessity of creating appropriate social environments as well as curiosity, motivation, self-control and personal observations, coinciding with the tendencies of metacognitive awareness. Therefore, it is important to

investigate the effect of fact-based learning approach on developing metacognitive awareness. For this reason, it is important to investigate the effect of the fact-based learning approach on improving metacognitive awareness.

Purpose of the research

The purpose of this study is to determine the effects of the learning activities conducted in accordance with the phenomenon-based learning approach on the metacognitive awareness level of the students. For this purpose, answers were sought for the following trials.

1. Is there a significant difference in favor of the post-test between the metacognitive awareness scale pre-test and post-test scores of the experimental group?
2. Is there a significant difference in favor of the post-test between the metacognitive awareness scale pre-test and post-test scores of the control group?
3. When the metacognitive awareness scale pre-test scores of the experimental group and the control group are taken under control, is there a significant difference in favor of the experimental group between the post-test scores?

METHOD

This section includes explanatory information about the research model, study group, application process of the research, data collection tools and data analysis.

Research design

This research was carried out according to the "pretest-posttest control group model". Pre-experiment measurement and post-experiment measurement were made in both groups. The pre-tests included in the model and applied to the groups before the applications helped to determine the similarity levels of the groups before the experiment, and the post-tests helped to interpret the results (Cohen et al., 2007). The experimental design of the research is given in Table 1.

When Table 1 is viewed, it is seen that the dates of the applications performed during the experimental procedure and the pre-test and post-tests applied to the groups in the experimental and control groups are included.

Study group

The research carried out during the teaching process of the 7th grade social studies lesson "Individual and Society" learning area lasted 4 weeks in both the experimental group and the control group. The sample of the study consists of 60 students of two different classes of same grades in 2019-2020 education year that are educated in the West Black Sea Region in Turkey. The distribution of students in the sample group is given in Table 2.

When Table 2 is viewed, it is seen that there are 16 female and 14 male students in the experimental group, and 13 female and 17

Table 1. The experimental design of the research.

Groups	Pre-tests	Experimental process	Post-tests
Experimental	Metacognitive awareness scale	Teaching activities within the scope of the phenomenon -based learning approach	Metacognitive awareness scale
Control	Metacognitive awareness scale	Teaching activities based on traditional teaching approaches	Metacognitive awareness scale

Table 2. Distribution of students in the experimental and control groups.

Groups	Female		Male		Total	
	N	%	N	%	N	%
Experimental	16	53.3	14	46.7	30	50
Control	13	43.3	17	56.7	30	50

Table 3. Comparison of the metacognitive awareness scale pretest scores of the experimental and control group.

Groups	N	Ss	sd	t	p
Experimental	30	40.82	8.47	58	0.34
Control	30	42.02	8.68		

$P < 0.05$.

male students in the control group.

Equalization of groups

In the equalization process of the subjects within the scope of the research, it is aimed to be careful about having students with similar characteristics in both experimental and control groups. Thus, other variables that could affect the experimental and control groups were tried to be controlled.

For this purpose, in adjusting the subjects within the scope of the research;

1. From the data obtained from the metacognitive awareness scale pre-test scores,
2. The lesson teachers' ideas about the cognitive and affective characteristics of students were used.

Comparison of the metacognitive awareness scale pretest scores of the experimental and control group

Information on whether the experimental and control groups are equivalent in terms of the metacognitive awareness scale before the experimental procedure or not is presented in Table 3.

When Table 3 is examined, it is seen that the pre-test scores of the metacognitive awareness scale of the experimental and control groups were compared before the application. The pre-test average score of the experimental group ($\bar{x} = 40.82$), the standard deviation value ($S_s = 8.47$), the average of the pre-test scores of the control group ($\bar{x} = 42.02$), the standard deviation value ($S_s = 8.68$) were

found.

Whether there is a significant difference between the pre-test average scores of the experimental and control groups was calculated with the unrelated samples t-test technique [$t(58) = .34$; $P < 0.82$] and the difference was not statistically significant. According to the result, it can be said that the experimental and control groups are equivalent in terms of the "The Metacognitive Awareness Scale" pre-test scores.

Application process

In the process of teaching the learning area "Individual and Society" in 7th grade social studies lesson, the practice was carried out in the experimental group 3 h a week. The research was carried out in three stages: preparation, implementation, data collection and evaluation.

Preparation phase

A 4-week daily lesson plan in which the teaching based on the phenomenon -based learning approach will be applied were prepared for the students in experimental group. The lesson plans were prepared according to the phenomenon based learning approach. Lesson plans were prepared according to the principles of planning, monitoring and evaluating learning, which will include independent study elements of the students and increase their metacognitive awareness.

"The Metacognitive Awareness Scale" was administered to the student as a pretest before the experimental procedure was started.

Implementation Phase (11 October - 01 November 2019)

Lessons are taught based on creating learning questions, research, project preparation, problem solving and application. The implementation was made in the process of teaching the subjects "The way that goes from human to human, the power of communication, fast communication, strong society, freedom of communication". The teacher starts the lesson by presenting questions or problems. The lesson begins with the students seeking answers to the questions or problems posed about a phenomenon that concerns them in cooperation. During the process, students were asked to prepare questions about concepts and phenomena in accordance with the content of the subject, (What is communication? What is fast communication? Etc.) With this implementation, the holistic dimension of the phenomenon-based learning approach is applied.

Students are divided into heterogeneous groups in order to formulate answers to the questions or problems they prepared about a phenomenon according to their interests before each lesson. With this implementation, it is aimed that students have deep learning experiences. At this stage, students are encouraged to benefit from other courses, library, technological tools and communication tools and students are given time. They are asked to make connections with the aims and topics of different courses. In this process, an authentic learning environment is created by providing various tools regarding the questions. Students are enabled to gain knowledge and skills as a result of a more meaningful learning experience by activating themselves through the process of solving the questions they put forward. In this process, the student discovers the facts with the group friends. At this stage, students also use know-want-learn activities in order to gain the skills of determining their own learning goals, self-perception, interpretation. With these implementations, the contextuality dimension and the problem-based inquiry-based learning dimension are applied. In addition, at this stage, it is aimed for students to acquire monitoring strategies from metacognitive strategies.

Students plan the learning process themselves by creating their own learning tasks and tools. Students are asked to write their learning plans, which are determined by them or by the group, on their worksheets. The aim is to make it easier for students to learn something new in a systematic way. Students present the solutions of the questions they form about the facts in the way they want and make self-evaluation. With this application, the learning process dimension of the phenomenon-based learning approach is applied. In addition, it is aimed that students will gain planning, monitoring and organizing strategies from metacognitive strategies due to planning for the process of solving a problem or completing a task, selecting and organizing relevant materials.

Data collection and evaluation phase

After the experimental process was completed, "Metacognitive Awareness Scale" was applied as a post-test to determine the effect of the application using the phenomenon-based learning approach on the metacognitive awareness levels.

Data collecting tools

Metacognitive awareness scale

In order to measure the metacognitive awareness level of the students, form B metacognitive awareness of the scale which was developed by Sperling et al. (2002) and was used adaptive optimized reliability and validity study done in Turkey by Karakelle and Saraç (2007) was used. The scale consists of 18 items as a

five-point Likert type (never, rarely, sometimes, often, always). The reliability of the scale was examined through test-retest and internal consistency coefficients, and its validity was examined through the lower-upper group method and item total score correlation, and it was found that the scale was valid and reliable at an acceptable level. The Cronbach's Alpha value for the scale was calculated as 0.80, which showed that the scale was reliable. The lower upper group method was used to determine the item validity of the scale. The difference between the mean scores of the participants in the 27% slice of the lower upper and lower scores of the scale was examined with the t test and ($t = 46.11, P < 0.001$) it was found that there was a significant difference. It was also stated that the scale should have a single factor structure and it would be appropriate to use it as a single total score (Karakelle and Saraç, 2007). The highest score that can be obtained from the scale is determined as 90, and the lowest score is determined as 18.

Analysis of data

Arithmetic mean (\bar{x}), standard deviation (Ss), frequency (f), percentage (%) t-test were used in the analysis of the data obtained. In addition, for each relationship, effect size (Cohens' d) values were calculated in order to explain the strength of the relationship. Effect size (Cohen's d) is the statistical value calculated according to the difference of Group averages showing the deviation of the results obtained from the sample from expectations (Cohen, 1994). The meanings given to the effect size score values are as follows; The range up to 0.2 has been interpreted as no effect, 0.2 to 0.5 range of small effect, 0.5 to 0.8 medium effect, and over 0.8 large effect. In addition, when the pre-test scores of the students in the experimental group and the control group were taken under control, covariance analysis was conducted to determine whether there was a significant difference according to the post-test scores. When significant difference was found between the groups, the eta squared (η^2) value was checked for the effect size of the difference. Accordingly, it has been interpreted as no effect up to 0.01, small effect between 0.01 and 0.06, medium effect between 0.06 and 0.14, and large effect above 0.14 (Green et al., 2000). 0.05 level and 95% confidence interval were used in the interpretation of the data.

RESULTS

The results regarding the findings obtained from the research are as follows. The first hypothesis of the study is "Is there a significant difference in favor of the post-test between the pre-test and post-test scores of the metacognitive awareness scale of the experimental group?" in the form. While obtaining the findings regarding this hypothesis, t-test was used for dependent groups. The findings obtained are presented in Table 4.

When Table 4 is examined, it is seen that the experimental group students have the metacognitive awareness scale as follows: pre-test mean score ($\bar{x} = 40.82$), standard deviation (Ss = 4.27), post-test mean score ($\bar{x} = 84.56$), standard deviation (Sd = 4.76). The difference is in favor of the final test. Whether the difference between pre-test scores and post-test scores is significant or not was interpreted with the t test obtained [$t(29) = 2.64; P < 0.02$] value and the difference was found to be statistically significant.

The effect size of the difference between pre-test

Table 4. Comparison of the experimental group's cognitive awareness scale pre-test and post-test mean scores.

Tests	N	Ss	sd	t	p	Cohen's d	
Pre-test	30	40.82	4.27	29	2.64	0.02	2.06
Post-test	30	84.56	4.76				

Significant level: $P < .05$.

Table 5. Comparison of the control group's cognitive awareness scale pre-test and post-test mean scores.

Tests	N	Ss	sd	t	p	Cohen's d	
Pre-test	30	42.02	3.72	29	1.64	0.00	0.04
Post-test	30	58.56	2.78				

Significant level: $P < .05$.

Table 6. The results of the covariance analysis regarding the comparison of the metacognitive awareness scale post-test average scores of the experimental and control groups.

Source	Sum of squares	Sd	F	P	η^2
Group	625.449	1	42.54*	0.00	0.27
Error	866.413	57			

Significant level: $P < .05$.

scores and post-test scores of the experimental group was calculated as (d: 2.06). It is seen that the experimental procedure performed had a great effect on the metacognitive awareness of the experimental group.

The second hypothesis of the research is; "Is there a significant difference in favor of the post-test between the pre-test and post-test scores of the metacognitive awareness scale of the control group students?" While obtaining the findings regarding this hypothesis, a t-test was used for dependent groups. The findings obtained are given in Table 5.

When Table 5. is examined, it is seen that the students in the control group have the metacognitive awareness scale as follows: pre-test average score (\bar{x} = 42.02), standard deviation (Ss = 3.72), post-test average scores (\bar{x} = 58.56), standard deviation (Sd = 2.78). The difference is in favor of the post test. Whether the difference between pre-test scores and post-test scores is significant or not was interpreted with the t-test; the difference with the value [$t(29) = 3.72$; $P < 0.00$] obtained was found to be statistically significant. The effect size of the difference between pre-test scores and post-test scores of the control group was calculated as (d: 0.02). It is seen that using traditional methods in teaching has a low effect on their higher cognitive awareness.

The third hypothesis of the research is; "Is there a significant difference in favor of the experimental group

between the metacognitive awareness scale post-test scores of the experimental group and the control group students?" Covariance analysis was used while obtaining the findings regarding this hypothesis. The findings obtained are given in Table 6.

In Table 6, when the metacognitive awareness scale pre-test scores of the experimental group and the control group are taken under control, there is a significant difference in favor of the experimental group in terms of post-test scores [$F(1,57):42,54$; $P < 0.00$]. Accordingly, it can be said that teaching based on the phenomenon-based learning approach has a great effect on increasing students' metacognitive awareness compared to traditional teaching.

DISCUSSION

According to the findings, the following results were obtained:

In the study, when the findings obtained from the metacognitive awareness scale of the experimental group were examined, it was observed that the teaching activities carried out in accordance with the phenomenon-based learning approach were effective in increasing the metacognitive awareness of the students. When the

findings obtained from the metacognitive awareness scale of the control group were examined, it was found that using traditional methods in learning activities could significantly increase students' metacognitive awareness levels. When the findings obtained from the metacognitive awareness scale of the research were examined, it was concluded that; this increase had a low level of effect on the metacognitive awareness scale and that the learning activities carried out in accordance with the phenomenon-based learning approach was more effective in increasing students' metacognitive awareness levels than teaching based on traditional method.

The significant difference in the results related to metacognitive awareness, that is, the phenomenon-based learning approach positively affected the metacognitive awareness can be explained as follows; this approach is based on questioning and problem solving skills. In addition, this approach can be considered as an important factor in making the difference meaningful since it enables the student to plan, perceive and interpret. In the origin of the phenomenon-based learning approach, curiosity, motivation, self-control and personal observations are important for students to examine a real holistic phenomenon related to their environment (Silander, 2015). In this respect, it can be accepted as normal that the students' metacognitive awareness level is high in the group in which the phenomenon-based learning approach is used. The purpose of the phenomenon-based learning approach is to provide students with a life experience in order to increase their desire to study and provide learning opportunities. In this learning approach, students are required to actively acquire and process information, use the necessary skills, draw conclusions, reach learning outcomes, and be versatile active learners (Linturi, 2014; Zhukov, 2015). Metacognitive awareness plays a critical role in the student's learning process as well as being independent and autonomous and performing more effective learning (Livingston, 1997). Because students with high metacognitive awareness know where and when to use the knowledge (Wilson and Conyers, 2016) According to Raahan (2016), in a classroom in which the phenomenon-based learning approach is used, they are not seen as a passive receivers of knowledge, but as learners and active participants that contribute to their own learning. The phenomenon-based learning approach is a multidisciplinary approach based on inquiry and problem solving skills (Symeonidis and Schwaz, 2016). Learning culture, which is tried to be created through the strategies and activities used specific to this approach, has positively reflected in metacognitive awareness, the development of operational knowledge and planning fields. As a matter of fact, according to Wakil et al. (2019)'s result of the research, they stated that the phenomenon-based learning approach facilitates learning and the learned information is more permanent. According to the study of Adaktylou (2020) in determining the effects of phenomenon-based teaching, students stated that they

behave like real scientists, improve their scientific literacy, obtain the necessary data, analyze and evaluate them. Similarly Wakil et al. (2019) stated that the phenomenon-based learning approach facilitates learning and the learned information is more permanent.

In summary, this study shows that the phenomenon-based learning approach contributes to the development of students' metacognitive awareness. As the results of the research reveal, since the applications supported by the phenomenon-based learning approach have a positive effect on the metacognitive awareness of the students, it should be ensured that the lessons are structured in accordance with the phenomenon-based learning approach and the metacognitive awareness of the students is increased by using the activities supported by the phenomenon-based learning approach in different courses.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

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