Investigating the Effect of Concept Teaching Strategy on Academic Success

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Abstract

This study examined the effect of concept teaching on students' learning level of concepts through concept teaching strategy; hence, a quasi-experimental design with pretest–posttest measurements and experimental and control groups was employed. An achievement test was created by the researcher to determine the experimental and control groups; this test was administered to 129 students studying in Grade 3, and the KR20 reliability coefficient was found to be .846. The pretest data were analyzed by independent groups' t-test. As a result of the analysis, two groups that were identical to each other were randomly assigned as experimental and control groups. While the concepts such as governor, district governor, mayor, and headman, which are the concepts determined from the life science curriculum, were taught to the experimental group with the help of concept teaching strategy, a program-based teaching was conducted for the control group. After 5 weeks of application, a posttest was administered to the experimental and control groups. As a result of the dependent group t-test, a significant increase in the posttest scores of the experimental and control groups was observed. As a result of the independent groups' t-test, a significant difference was noticed in favor of the posttest scores of the experimental group.

Keywords: Concept Teaching Strategy, Concept Development, Life Science, Primary Education, Early Childhood.

DOI: 10.29329/ijpe.2022.459.18

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INTRODUCTION

People's understanding of the world is related to their understanding of concepts. Concepts are perceived as the basis of human thinking and have an important place in the process of understanding the world and structuring what an individual has learned in this process. Concepts are the basic elements for developing one's knowledge and forming the basis for subsequent learning (Novak, 1971); moreover, they are related to language. Therefore, it is believed that they were invented by human beings. Concepts have emerged with the human desire to understand the world and express their understandings about it. Therefore, concepts cannot be considered independently of humans (Merrill, Tennyson, & Posey, 1992). From the moment people come into the world, they encounter many things, ideas, and events. Concepts allow us to distinguish these structures from each other and establish relationships between them (Klausmeier & Harris, 1966).

Concepts are abstract and generalized forms of objects and phenomena that can be expressed in language and are categorized objects, events, and sets of ideas (Eggen & Kauchak, 1999). They are grouped on the basis of similar ideas, events, processes, and objects (Senemoğlu, 2003). They have descriptive characteristics or attributes, which separate their examples from examples of other concepts. It is regular information that enables a person to distinguish or associate one or a group of objects from others (Prater, 1993). Concepts, principles, and rules guide us to solve new problems that arise in situations we have never encountered before (Nisbett, Fong, Lehman, & Cheng, 1987).

One of the requirements for understanding concepts is classifying information. Concepts are a network of inferences and consequences that emerge by categorizing phenomena, events, ideas, and objects (Prater, 1993; Ribovich, 1979). They are mental tools. With these mental tools, individuals can think about the world they live in, understand the world and the environment, and communicate. Understanding concepts makes it easier to understand much more complex information, principles, and phenomena. At the same time, it provides a relationship among events, ideas, and various information (Senemoğlu, 2003). According to Ausubel (1968), meaningful learning occur when a learner associates newly learned concepts with old concepts and place them in subsets (Novak, 1971). Different aspects of a concept can be thought of as different levels within a category system. In other words, to understand a concept well, it is necessary to know the different concepts in the categories within the concept and their relations with each other.

Childhood is the fastest period during which concept formation occurs because many concepts encountered in childhood are new, and the world becomes meaningful if these concepts are cognitively regular. (Ribovich, 1979). There are three aspects of concept formation, namely, the term describing the description of phenomena or events, the features or attributes that define them, and the concept. Concept formation occurs if there is a good harmony among these three aspects (Gerring, 1999). In the concept formation process, the individual performs three processes: generalization, distinction, and definition. In the generalization process, concepts are grouped according to their common features. In the process of distinction, differences of assets with common characteristics are determined. In the definition process, a proposition that defines the concept is reached from the similar and different characteristics of these entities (Senemoğlu, 2003; Ülgen, 2004). According to Ülgen (2004), concept learning is the job of creating and structuring information in the mind by categorizing stimuli into certain categories. According to Martorella (1974), if teachers or educational programers want to facilitate concept learning, they should pay attention to the three following situations. First, every feature that is not related to the concept should be eliminated. If features that are not related to the attribute of the concept are added, it is thought that this factor may attract the attention of the student in a different direction. Second, the features of giving examples are related to the concept. After providing an explanation that thoroughly explains the concept, examples that are not explanations of comprehension should also be given. This factor enables the learner to clearly observe the similarities and differences. The third situation is to be able to create various images; as a consequence, inferences can be drawn about partnerships, and generalizations can be made about the concept.

Although concepts start with observation and experience from the birth of the child, school is one of the most important steps of concept learning (Markle, 1975). Success in different fields such as mathematics, science, and life science is associated with learning concepts from preschool to university (Martorella, 1974). While children come to school having learned many concepts, they come with a very few concepts on the scientific concepts' front. When children come to school, their cognitive structure is not systematic wherein they can explain their environment mentally. Only when their environment is configured properly, they can understand concepts and principles, perceive cause–effect relationships, or solve problems (Novak, 1971). For this reason, concept teaching is one of the basic and most important subjects in primary school as in every education step. In particular, while teaching a new subject, teachers try to teach students general concepts related to it (Ribovich, 1979). Klenner-Moore (2004) stated that children need the support of an adult, especially in learning abstract concepts. In this process, adults can make it easier for students to learn concepts by structuring the learning process.

One of the most important effects in making the concepts meaningful and organized is systematically learning the concepts. There are two basic approaches in concept teaching: deductive and inductive. In the deductive approach, the name and definition of the concept are provided. Thus, the basic elements of the concept are shaped in a student's mind. Thereafter, the distinctive features of the concept, examples of the concept, and non-examples of the concept are given (Erden & Akman, 1997; Gürdal, Şahin, & Çağlar 2001).

In the inductive approach, examples of the concept are set out. First of all, by giving examples or examples that best describe the concept, it is ensured that students build arguments for common features of the concept. In the next step, non-exemplary examples of the concept are given. While giving non-exemplary examples, it is necessary to give examples of concepts that have common features with the concept but are not included in the class in which the concept is included. This process continues until the students clarify the name, definition, and features of the concept (Erden & Akman, 1997; Gürdal, Şahin, & Çağlar, 2001).

Michaelis and Garcia Concept Teaching Strategy

One of the tools used in the systematic teaching of concepts is concept teaching strategies. When the literature is examined, we find many concept teaching strategies. Although concept teaching strategies differ in terms of functioning, concepts are addressed in the teaching process either with a deductive or inductive perspective. Another key point is that students know the meaning of the concept and the defining characteristics and descriptions of the concept at the end of the activity.

Based on concept learning approaches, there are many strategies, methods, and models that can be applied while introducing students to concepts. In this study, Michaelis and Garcia's concept teaching strategy was used to teach concepts. This strategy composed of five stages. When these stages are examined, it is observed that they contain the characteristics of various concept strategies. Hence, it is very rich in terms of number of activities in the process of teaching the concept (Dündar, 2007). The five stages are given below:

Defining: In this step, the activities in the subheadings of behavioral and functional definitions such as showing, showing using examples, using synonyms and antonyms, and using dictionaries are employed to create definitions of concepts for students.

Distinguishing example and non-examples: After the concept is explained, examples of the concept are given; further, examples that are similar to the concept but are not direct examples are given. In this way, students' confusion about the concept is prevented by highlighting the differences between the concepts.

Listing, grouping, and naming: Examples of a concept are classified, generalized, and named.

Problem-solving or research: After giving general information about the concept, the steps of the problem-solving method are applied by creating a problem related to the concept or addressing an existing problem. Another activity that can be performed at this step for students is to research questions about the concept.

Providing types of learning activities: This stage starts with exercises that students concretely perform and are accompanied by students' symbolizing information on the subject.

Purpose and importance of the study

In this study, the concept teaching strategy of Michealis and Garcia was used as a basic method in the concept teaching process in life science lessons. Life science is a lesson wherein students formally and informally learn concepts that they frequently encounter in daily life. When the content of the life science course is examined, students relate some concepts to their daily lives such as family, home, and school, and their readiness is high; while there are concepts such as the republic, voting, freedom, and democracy that directly affect students' daily lives, but their readiness is low because they are not aware of this effect. It is important for students to be able to learn such concepts by examining them in various dimensions, in order to realize the impact of their democratic rights on their daily lives. In addition, the study is important in terms of making students realize who they can get support from in the problems they encounter in their local environment, as well as realizing how they have an impact on the functioning of their local environment with the votes they cast. In addition, these concepts are also important in terms of preparing the infrastructure for many citizenship skills in the life science course. For this purpose, to ensure that these concepts are as permanent as possible, it is important to plan activities systematically. In this study, it is aimed that students learn the concepts of governor, district governor, mayor, headman and examine local government units from different perspectives by using the Michaelis and Garcia Concept Teaching strategy. This study aimed to determine whether this strategy makes a meaningful difference in the learning process by trying to gain concepts through rich activities using the concept teaching strategy. In addition, the answers to the following research questions (RQs) are sought:

RQ1: Is there a significant difference between the pretest and posttest scores of the experimental group learning the concept with concept teaching strategy?

RQ2: Is there a significant difference between the pretest and posttest scores of the control group learning the concept with a program-based teaching strategy?

RQ3: Is there a significant difference between the posttest scores of the experimental group learning the concept with concept teaching strategy and the control group learning the concept with program-based teaching strategy?

METHOD

Research Design

A quasi-experimental design with the experimental and control groups was employed in the study. In studies arranged according to a quasi-experimental design, the effect of the independent variable is determined by applying it to the experimental group (Ekiz, 2015). In this study, two groups that were identical to each other were determined by applying a pretest and were randomly assigned as experimental and control groups. While the concept teaching strategy was employed for the experimental group during the concept teaching process, the control group continued the program-based education process. After the learning process of the concepts was completed, a posttest was administered to the experimental and control groups, and the effectiveness of the concept teaching strategy was determined.

Research Group

Since the outcome that is the subject of the study is included in the third grade life studies course "life in our country", the third grade students who will form the study group first were chosen. To decide the sample group, a school was selected using a random cluster sampling method. Cluster sampling is a common unit that contains many units in which there are many elements (Christensen, Johnson, & Turner, 2015). As a result of the pretest administered to the Grade 3, two classes that were equivalent to each other were randomly assigned as experimental and control groups. In all, 43 Grade 3 students (experimental group = 23 and control group = 20) constitute the study group of the research.

Academic Achievement Test

In the study, the academic achievement test developed by the researcher was used to measure the academic success of the experimental and control groups before and after the procedure. While preparing the academic achievement test, the life science curriculum (2018), the life science textbook (2018), and Turkish Language Association (2019) dictionary were used. Considering that some test items could be eliminated during the pre-application process, at least three question items were written to measure each concept. The academic achievement test consisted of 21 questions with 3 options in Stage 1. To obtain expert opinions about the academic achievement test, two academicians and four classroom teachers were consulted. After the opinions were received, additions and deletions were made in the test, and the 17-item 3-option academic achievement test was finalized.

The pre-application of the academic achievement test was administered to 129 students, and all the data were included in the study. To determine the reliability of the test applied to 129 students, the KR20 reliability coefficient formula was applied, and the reliability of the test was determined as .838 in Stage 1.

The difficulty and distinguishing indexes of the items that make up the test were determined. Item distinguishing index is the measure of an item to distinguish students who know or do not know the question. Items with an item distinguishing index of .40 and above are considered very good items, items between .30 and .39 are considered good items, items with .20 and .29 should be corrected items, items with less than .19 are considered weak items. When the distinguishing indexes of the items in the achievement test were examined, it was determined that only the distinguishing index of Item 8 was below .19, and it was excluded from the test. After its exclusion from the test, the KR20 reliability coefficient was determined to be .846. A KR20 reliability coefficient of over .70 is generally considered sufficient for the reliability of the test (Büyüköztürk, 2011). The distinguishing indexes of the remaining items are between .32 and .73. The item difficulty index gives an idea about whether the item is difficult or easy. In the literature, items with an item difficulty index of .29 and below are considered difficult, items with .30–.49 have medium difficulty, and items between .50–.69 and .70–1 are considered as easy. What matters at this point is the average difficulty of the test. Ideally, the average difficulty of the test is close to .50 (Tekin, 2010). In this study, the average item difficulty index of the academic achievement test was determined as .59. In this sense, it can be said that the test is of average difficulty.

Application Stages

While planning the study, the concepts subjected to the application were first determined. For this purpose, the life science curriculum and life science textbooks were examined. When life science programs and textbooks are examined, it is observed that many abstract and concrete concepts are the subject of life science lessons. For this reason, certain criteria have been tried to be included while determining the concepts. First, attention has been paid to the fact that the concepts chosen are the ones that students cannot learn informally. Concepts that do not directly affect the daily lives of students or that they do not use very often in their daily conversations, which are close to each other in terms of meaning and function, and might be confused by students are specifically selected. For this reason, concepts such as governor, district governor, mayor, and mukhtar in the unit "Life in Our Country" were determined as concepts to be taught. After the concepts were determined, activities

were organized in accordance with the stages of Michaelis and Garcia's concept teaching strategy. Sample activities for the governor concept are given below:

Stage 1: Defining: After informing that governor as a concept will be taught, the concept was explained. The students were asked to find the term governor from the dictionary and look up its meaning. Students were asked to share the definitions they find in a way that they do not repeat.

Behavioral definition: It is reminded that the governor is the most authorized person representing the state in a province. It is stated that this person is in charge of ensuring the safety of the society and providing services such as education and health services.

Functional description: Students were asked about what changes they want to make to their school and write a letter to the governor regarding this issue.

Showing: Photos of the governor of the city where the students live were shown. An average of one-minute videos was shown wherein the governor is in protocol, supervision, and office.

Using examples: At this stage, the concepts of governor–school principal and city–school were compared to each other, allowing students to learn about the basic duties of the governor as an administrator without going into much detail. The students were asked about the duties of the school principal. Based on the answers received, it was explained that the governor has a similar duty to maintain order in the city.

Synonyms and antonyms: Concepts such as governor–school principal, city–province, junior–senior, task–duty, and responsibility–liability are explained.

Using a dictionary: The words explained in the Synonyms and Antonyms Activity are examined again from different dictionaries, and the relationship between them is examined.

Stage 2: Distinguishing between examples and non-examples: After introducing the concept and definition of the governor, students were informed that each province has a governor; examples were given related to the governor of the province they live in, the governors of neighboring provinces, and the governors of the provinces they are familiar with, such as Ankara and Istanbul.

The non-example of the governor concept was specified as mayors in provincial centers. They were informed that the mayors were also the persons in charge of conducting some services in the city and were to be found in each city.

3- Listing, grouping, and naming: Students were given the names of six provinces and six districts from the city they live in. If these names were to be divided into two groups, they were asked how they could group them. After the students grouped them into provinces and districts, the question "Who is the most authorized person representing the state in the province?" was asked.

Stage 4: Problem-solving research: At this stage, a research assignment was given. Students were asked to research and report the first female governor of the country and her life story and present it to the classroom.

Stage 5: Providing types of learning activities: At this stage, students were expected to discuss and reflect on the subject by giving a case study. The case study was created on the authority of governors to give a snow holiday in severe winter conditions, which students were very interested in.

The following case is given: "…. Heavy snowfall is observed in the city center during the winter months. It snows very often in the high regions in the city center, and there are problems in transportation due to heavy snowfall. There may be problems in transportation to schools, particularly in rural areas. One of the most important problems is the access of students who go to school with bussed education in rural areas. The governor wants to give a snow holiday in case the students

encounter an unfavorable situation during the journey, but this situation causes disruption of the education and training, as most of the winter passes with heavy snow in the city center. Therefore, the governor has a dilemma between these two important issues. If you were a governor, what kind of solution would you provide for such a situation?" Based on the given case study, it is aimed that students use the problem-solving steps to determine their answers.

The activities for each concept lasted an average of 5 lesson hours, and the experimental process took 5 weeks in total. On completion of the experimental process, a posttest was administered to the experimental and control groups, and it was examined whether there was a significant difference in the knowledge levels of the experimental and control groups regarding the concepts.

RESULTS

To decide the test to be used to measure the equivalence of the experimental and control groups' knowledge levels, it was first determined if the data collected was normally distributed. The Shapiro–Wilks test was used to measure the normality of the data. Further, it was determined that the data of the experimental and control groups were normally distributed. While the p-value for the experimental group was .264, it was determined as .595 for the control group. After determining that the groups were distributed normally, independent groups' t-test was applied to determine the equivalence of the groups. Table 1 contains the independent groups' t-test results ($p > .05$).

Table 1 Experimental and Control Groups' Pretest t-Test Results

Groups	N	Average	Standard deviation	t	p
Experimental group pretest	23	8,87	4,003	-, 399	, 692
Control group pretest	20	9.35	3,870		

As a result of the analysis, it was determined that there was no significant difference between the pretest results of the experimental and control groups. In other words, it can be said that the knowledge levels of the groups about the subject before the experimental procedure are equal.

To determine whether there is a significant difference between the knowledge levels of the groups after the experimental process, it was analyzed with the posttest whether the data obtained were normally distributed. The normality of the data was tested with the Shapiro–Wilks test, and while the p-value for the experimental group was .105, the p-value for the control group was determined as .731. As the groups showed normal distribution, dependent and independent groups' t-test was applied for the analysis of the posttest results of the groups. The dependent groups' pretest and posttest t-test results of the experimental group are given below:

Table 2 Experimental Group's (Dependent Group) t-Test Results

Groups	N	Average	Standard deviation	t	p
Experimental group pretest	23	8,87	4,003	-, 10,349	, 000
Experimental group posttest	23	13,00	2,256		

When the experimental group's pretest–posttest dependent groups t-test results are compared, it is seen that there is a significant difference in favor of the experimental group's posttest results. The posttest scores of the experimental group increased in a way to create a significant difference. The dependent groups' pretest and posttest t-test results of the control group are given below:

Table 3 Control Group's (Dependent Group) t-Test Results

Groups	N	Average	Standard deviation	t	p
Control group pretest	20	9.35	3,870	-3,199	, 005

Control group posttest	20	10.05	3,620

When the dependent group t-test results of the control group are examined, it is seen that there is an increase in favor of the control group's posttest scores. As a result of the t-test, it was determined that there is a significant difference in favor of the posttest scores of the control group. To determine the effectiveness of the experimental process, an independent group t-test was conducted to see whether there is a significant difference between the posttest scores of the experimental and control groups. Independent groups t-test results are given below:

Table 4 Experiment and Control Groups' (Independent Groups) t-Test Results

Groups	N	Average	Standard deviation	t	p
Experimental group posttest	23	13,00	2,256	3,252	, 002
Control group posttest	20	10.05	3,620		

When the experimental and control groups' posttest results were compared, it was determined that there was a significant difference in favor of the experimental group. In other words, it was revealed in the posttest that the knowledge level of the experimental group about the concepts learned was better than the control group. Based on this result, it can be deduced that using concept teaching strategies while teaching concepts is more effective than curriculum-based learning.

DISCUSSION AND CONCLUSION

Good comprehension of concepts is vital for students to have a sense of information, develop relationships, and learn more complex subjects. Concepts are the basic building blocks of knowledge. Thus, learning and understanding many subjects depend on the correct understanding and learning of the concepts (Birbili, 2007; Piaget, 2004; Piaget, 2019; Taba & Elzey, 1964). The learning of the concepts can occur both formally and informally. However, systematic approaches may be needed in particular for learning scientific and abstract concepts (Bracken & Crawford, 2010; Vygotsky, 2020; Vygotsky, 2021a; Vygotsky, 2021b). This study thus aimed to teach some concepts in the life science course with the aid of the concept teaching strategy, which will be the basis for many topics that the students will learn in their educational lives.

In this study, the pretest and posttest academic achievement test scores of the experimental group were compared, and a significant difference was observed in favor of the posttest scores. The pretest and posttest academic achievement test scores of the control group were compared, and a significant difference was found in favor of the control group's posttest scores. In other words, the knowledge level of the experimental group, which learned the concepts with the concept teaching strategy, and the control group, which learned the concepts through program-based concepts, increased significantly. When the posttest academic achievement test scores of the experimental and control groups were compared, it was determined that there was a significant difference in favor of the experimental group's posttest scores. Thus, it can be deduced that concept teaching strategy is more effective in the teaching of concepts than program-based learning. When the literature is examined, it has been determined that different concept teaching models, techniques or strategies used are effective in the concept acquisition process. It is seen that different concept development models are used at different grade levels in teaching concepts related to different courses and subjects such as life science, social studies, history, mathematics, informatics and technology. It has been shown that the models used in the direction of the studies are successful in the concept development process (Anwar, et. al, 2019; Björklund & Pramling, 2013; Chen et al., 2016; Çolak, 2010; Dagiene & Srupriene, 2016; Dündar, 2007; Gunawan et al, 2019; Jokabi-Vessels et al., 2016; Kaddoura et al, 2016; Kurniawan & Mashuri, 2021; Liu & McKeough, 2004; Nukman, et al., 2018; Ogannaya et al, 2016; Sakiyo & Waziri, 2015; Saputro et al. 2019; Setyowati et. al, 2019; Sukardjo & Salam, 2020; Turan, 2011; Wicaksono et al., 2020). It is seen that many different concept development models in this study and in the discussion section of the study are effective in learning concepts for students at different levels.

Even if different models, methods and strategies are used in the studies, common points draw attention. In all models, the acquisition of concepts proceeds in a cascading and highly planned manner. During the concept development process, different features of the concept were emphasized. It was ensured that the students were actively involved in this process. For this reason, it can be said that systematizing the concept development process, albeit with different tools, makes concept learning process more effective.

Suggestions for Researchers and Practitioners

In this study, Grade 3 students were selected. However, there are many concepts that students learn in Grades 1and 2 through their life science programs. Therefore, a similar study can be conducted with these students.

There are many strategies in the literature for teaching concepts. By choosing different teaching strategies, studies can be conducted related to the learning level of the concepts; studies can also be conducted on the effectiveness of concept teaching using different strategies together.

In this study, concept teaching strategies were examined in the context of life science lessons. A similar study can be conducted at the primary school level for life science, science, or mathematics lessons, and its effect on academic achievements can be examined.

As the textbooks usually deal with the subject through a deductive approach, teachers prefer to deal with the subject through concept teaching. By using different concept teaching strategies, they can enable students to discover and provide diversity in activities. Teachers' level of knowledge about such strategies is also important in this case. Hence, studies can be conducted to determine teachers' knowledge or perspectives on concept teaching strategies.

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