

An Analysis of Fifth Grade Mathematics Course Book in Terms of Advance Organizers

Özgür Şen (Corresponding author)

Faculty of Education, Bozok University, Yozgat, Turkey

E-mail: senozgur@yahoo.com

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Abstract

This study aims to analyse the advance organizers included in the course book “Secondary School Mathematics Course Book 5”—which was prepared in accordance with 2017 secondary school mathematics curriculum and which was accepted as an educational material by Turkish Education Board of Ministry of National Education for use in 2017-2018 academic year—in terms of use, functions and forms. Employing qualitative research method, this study uses document analysis. Content analysis is used in the analysis of the research data. It was found in consequence that comparative advance organizers comparing the previous and new knowledge were heavily used in the course book.

Keywords: Advance organizer, Course book, 5th grade

1. Introduction

The concept of advance organizers was first put forward by Ausubel (1968) (Chuang & Liu, 2014). Ausubel called organizer knowledge helping individuals to make sense of new knowledge encountered and making learners familiar with the subject by forming the framework for the knowledge to be gained “advance organizers” (Senemoğlu, 2005, p. 304). Advance organizers are the instruments presented before the material to be learnt and enabling learners to interpret and organize the new knowledge (Torres, 1993; Nakiboğlu, Kaşmer, Gültekin, & Dönmez, 2010). Besides, advance organizers—which are defined as knowledge helping students to build bridges between new knowledge and knowledge they already have—can be a concept, a principle, a figure, a chart or the basic ideas of a topic (Erden & Akman, 1996, p. 175). It was observed that the activities made learning meaningful when advance organizers were suggested as teaching strategies presenting brief information about course content before learning activities (Chuang & Liu, 2014).

Gagne points out that students’ participation in the task of learning and sustaining learning

depends on the using and recalling the previously learnt knowledge and skills which are directly related to the concepts to be learnt (Baykul, 2009). The newly learnt knowledge is combined with prior knowledge by means of advance organizers—which strengthen students' cognitive structure and help to retain knowledge in memory (Çakıcı & Altunay, 2006). Therefore, well-prepared advance organizers are the elements helping students to set up associations between concepts beside providing students with a meaningful and conceptual framework (Mayer, 1979). Due to the fact that advance organizers make the knowledge to be learnt meaningful, they prepare the framework into which detailed knowledge will be placed meaningfully (Fidan, 1985).

Mayer (1979) describes the properties of advance organizers as series of visuals or verbal information, presentation before knowledge to be learnt in greater detail, unavailability of specific information on knowledge to be learnt and helping to make logical connections between elements to of knowledge to be learnt (cited in Erdem, 1994). Advance organizers can be used by employing three different models: preparing students to learn, preparing them to learn all the details of the new subject and making students combine, merge and associate by making them apply the main principles of the new subjects through examples (Özbay & Erkan, 2009, p.295). Advance organizers are divided into two according to the way they are used, namely,

Explanatory organizers: They are used to help to be informed of a subject never encountered before and to help to develop a conceptual structure about the subject at the beginning of the subject. In this way, ties can be set up between the previous knowledge and new knowledge. For instance, summarising the new subject, presenting the related subjects schematically.

Comparative organizers: They are the organizers making comparison between the new knowledge and previous knowledge possible. Knowledge to be learnt can be presented by using analogies with a subject student already know very well (Erden & Akman, 1996, p. 175).

In addition to that, advance organizers can also be grouped as written advance organizers (asking questions, descriptive, narrative), oral advance organizers and graphical advance organizers (figures, charts, etc.) according to the way they are prepared (Nakiboğlu et al., 2010). What is important here is to use advance organizers suiting to the purpose (Aydın, 2004). Empirical studies demonstrating the positive effects of using advance organizers (Altunay, 2000; Erdem, 1994; Gürsoy, 2002; Bayat, 2006; Akdemir, 2010; Demir, 2011; Öztürk, 2012; Nakiboğlu & Kaşmer, 2017) as well as studies demonstrating that using advance organizers do not have any effects on students' achievement (Somyürek, 2004; Çakıcı, 2005) are available in the literature. Box (2003) concluded that cooperative learning approach in which advance organizers were used had positive effects on students' self-identity and on their academic achievement. Stone (1983) found that written advance organizers facilitated learning whereas Lin and Chen (2006) in their study conducted with students learning English as a foreign language found that advance organizers used as questions had positive effects but that animation advance organizers did not have any effects

on students' achievement. Luiten, Ames, and Ackerman (1980), on the other hand, examined published and unpublished 135 studies concerning the effects of advance organizers on learning and permanence and found that advance organizers had positive effects on both learning and permanence (Luiten, Ames, & Ackerman, 1980). In relation to the advance organizers included in course books, Gür and Kobak-Demir analysed the advance organizers included in 7th grade mathematics course books published by Ministry of National Education and by Ada Publishing in terms of functions and types. Accordingly, they concluded that limited number of comparative advance organizers were included in those books while greater number of explanatory advance organizers were included in the books. They also point out that only a limited number of studies are available in the literature analysing the advance organizers in course books (Gür & Kobak-Demir, 2015). Nakiboğlu et al. analysed 9th grade chemistry course books in the period between 1996 and 2007 and stated that the use of advance organizers in chemistry course books had increased in 2007 (Nakiboğlu et al., 2010). Aydın (2004), analysing 6th and 7th grade Turkish course books from the aspect of advance organizers, concluded that advance organizers were not sufficiently included in the books. It may be said in general that the studies concerning the correlations between advance organizers and mathematics are not sufficient.

One of the materials helping to learn is undoubtedly course books. Course books, which are the fundamental assistants of teachers in teaching, are the materials helping teachers to use their power better and to present their lesson in a more systematical way (Küçükahmet, 2006). Besides, it is also the task of course books to inform and lead students by taking on the job of teachers when teachers are not available (Altun, Arslan, & Yazgan, 2004). Therefore, using course books as effective and efficient sources is very important. This study aims to analyse advance organizers included in the 5th grade mathematics course book which was prepared according to the 2017 mathematics curriculum and which was put into use in 2017-2018 academic year in terms of their functions and forms.

2. Method

This study conducted in qualitative research method employs document analysis. The goal in document analysis is to analyse written sources having information on phenomenon or phenomena. The stages of document analysis are reaching the document, checking it for originality, understanding it, analysing the data and using the data (Yıldırım & Şimşek, 2011, p. 187). The source of data for the research is “Secondary School Mathematics Course Book 5”—which was prepared according to 2017 secondary school mathematics curriculum and which was accepted by the Ministry of National Education as an educational material for use in 2017-2018 academic year. The book entitled “Secondary School Mathematics Course Book 5” was reached on the official internet site (<https://www.eba.gov.tr>) of the Ministry of National Education.

2.1 Data Analysis

Prior to analysing the data, the categories were distinguished. A mathematics teacher was asked for help before moving on to the stage of coding. Because the aim is to evaluate the advance organizers in the 5th grade mathematics course book in terms of the way they are

used, their functions and forms and because advance organizers are used in comparative and explanatory ways, the organizers were coded and analysed in this way. Having completed the coding made by two people individually, agreement on the categories was reached through discussion. Later, the formula $\text{reliability} = \frac{\text{agreement}}{\text{agreement} + \text{disagreement}} \times 100$ was used (Miles & Huberman, 1994). Agreement between the researchers was found to be 97%. The data were analysed through content analysis.

3. Findings

This part presents the findings in relation to the analysis of advance organizers in “Secondary School Mathematics Course Book 5”—which was prepared according to 2017 curriculum for secondary school mathematics course—in terms of the way they are used, their functions and forms. A look at the curriculum indicates that there are 56 gains in total. The gains are divided into three different domains of learning: Learning domain of numbers and operations (33 gains), geometry and measurement (20 gains) and data processing (3 gains). Table 1 shows the results for the analysis of the advance organizers included in each domain of learning.

Table 1. Analysis of advance organizers included in sub-domains of learning in the 5th grade mathematics course book

Learning domains	Advance organizers		Functions			Forms					
			Associating with the gains processed	Emphasising concept	Attracting attention	Narration	Informative	Exemplifying	Asking questions	Visualising	Tabulating
Numbers and Operations	Explanatory	8	8	7	6	1	4	3	8	7	2
	Comparative	12	11	8	8	-	5	7	12	8	5
Geometry and Measurement	Explanatory	4	2	2	2	-	3	1	4	4	-
	Comparative	12	5	6	7	-	3	7	12	12	-
Data Processing	Explanatory	-	-	-	-	-	-	-	-	-	-
	Comparative	2	1	-	1	-	2	-	2	2	-
Total	Explanatory	12	10	9	8	1	7	4	12	11	2
	Comparative	26	17	14	16	-	10	14	26	22	5
Overall total		38	27	23	24	1	17	18	38	33	7

Accordingly, 20 advance organizers are available in the learning domain of Numbers and Operations. It was found that 8 of the advance organizers were explanatory while 12 were comparative advance organizers. It was also found that 8 out of 8 explanatory advance

organizers had the function of associating with the gains, 7 had the function of emphasising the concepts and 6 had the function of attracting attention while 11 out of 12 comparative advance organizers had the function of associating the processed gain, 8 had the function of emphasising the concept and 8 had the function of attracting attention. On analysing the advance organizers in the learning domain of Numbers and Operations in terms of forms, it was found that the greatest number of them was in the form of exemplifying (10 in total—3 of which were explanatory and 7 of which were comparative). One exemplifying advance organizer was found in which narration method was used. 4 explanatory and 5 comparative advance organizers were found in informative form.

16 advance organizers were available in the learning domain of Geometry and Measurement. It was also remarkable that greater number of advance organizers were included in this part. 4 of the advance organizers were explanatory and 12 were comparative type. Of the 4 explanatory advance organizers 2 had the function of associating with the gain, 2 had the function of emphasising the concepts and 2 had the function of attracting attention while 5 of the 12 comparative advance organizers had the function of associating with the processed gain, 6 had the function of emphasising the concept and 7 had the function of attracting attention. On evaluating the advance organizers in terms of form, it was found that narration was not used in the learning domain of Geometry and Measurement. Of advance organizers, 8 were in the form of exemplifying and 6 were in the form of informing. In the learning domain of Data Processing, there were 2 comparative advance organizers. 1 of the advance organizers here had the function of associating with the processed gain and 1 had the function of attracting attention.

It is clear from the overall total that there are 38 advance organizers in total in the book—12 of which are explanatory and 26 of which are comparative. 27 of the advance organizers have the function of associating the process with the gain, 23 have the function of emphasising the concept and 24 have the function of attracting attention. In addition to that, questions are asked in all of the advance organizers, visuals are used in 33 of them and tables are used in 7 of them.


Gezegeler ve Uzaklıklar

Galaksimizde birçok gezegen vardır. Bu gezegenlerden bazılarının Güneş'e olan ortalama uzaklıkları aşağıdaki tabloda verilmiştir.

Tablo: Gezegenlerden Bazılarının Güneş'e Olan Ortalama Uzaklıkları

Gezegeler	Güneş'e Olan Ortalama Uzaklık (km)
Merkür	58 000 000
Dünya	150 000 000
Mars	228 000 000

Siz bir astronot olsaydınız hangi gezegene yolculuk yapmak isterdiniz?
Tablodaki sayıları okumaya çalışınız.
Milyon ve milyar sözcüklerini daha önce duydunuz mu? Örnekler veriniz.



Translation:

Planets and their Distance

There are a lot of planets in our galaxy. The average distance from some of those planets to the sun is shown in the table below.

Table: Average Distance from some of the planets to the sun

Planets	Average distance to the sun (km)
Mercury	58,000,000
Earth	150,000,000
Maro	228,000,000

If you were an astronaut, which planet would you like to travel to?

Try to read the numbers in the table.

Have you ever heard the words million or billion before? Give examples.

Figure 1. A sample for explanatory advance organizers in the learning domain of numbers and operations

Figure 1 is an example for the explanatory advance organizer used on page 12 in the course book. This is an advance organizer presented at the beginning of processing the gains stated as “*Reading and writing nine-digit numbers at the maximum*” and “*Explaining the order of nine-digit natural numbers at the maximum, digits and the digit values of numbers*”. The gain students “*Read and write 4, 5 and 6-digit numbers*” is available for grade four. Considering the fact that students had not learnt to read and write 9-digit numbers since it was not taught at primary school level, the gain to be processed was associated by offering informative explanation on where to use those numbers. The statement “*Try to read the numbers in the table*” is for attracting students’ attention while the question “*Have you ever heard of the words million and billion? Give examples*” is for emphasizing the concept to be taught. These questions are for the first gain processed, and no advance organizers are available for the second gain to be processed.

Dikdörtgenler Prizması

Küp Kütüphane

18. yüzyıldaki Fransız Milli Kütüphanesi'nden esinlenilerek yapılan Stuttgart Şehir Kütüphanesi'nin yapımı 2011 yılında tamamlanmıştır.

Küp şeklinde olan kütüphaneye dört taraftan da giriş yapılabilmekte ve küp şeklindeki binanın içi ana kapıdan yayılan ışıkla aydınlanmaktadır.

Binanın küp şeklinde olduğu nasıl anlaşılır?

Sizce binanın küp şeklinde olması ne gibi avantajlar sağlamıştır?



Anahtar Kelimeler

- Prizma
- Küp

Translation:

Rectangular Prism

A Cubic Library

Stuttgart city library, which was built being inspired by the French national library of the 18th century, was completed in 2011.

There are entrances to the cubic library on the four sides of the building, and the light on the main entrance illuminates the inside of the building.

How do you understand that the building is in the shape of a cube?

What advantages does cubic shape of the building provide in your opinion?

Figure 2. A sample for comparative advance organizers in the learning domain of geometry and measurement

Figure 2 shows an example for comparative advance organizers used on page 300 in the course book. The gain in this respect is “*Determining rectangular prism and its basic elements*”. Students are expected to know of cubes and rectangular prisms at the levels of 1st-4th grade. For this reason, advance organizers helping to set up connections between students’ prior knowledge and new knowledge are available. However, because the gain to be processed is related to rectangular prisms, no associations are set up between new knowledge and prior knowledge and thus no connections are set up. The question “*How do we understand that a building is in the shape of a cube?*” functions as attracting attention.

► Üçgen Çeşitleri ve Dörtgenler

Gemiler

Çok eski zamanlardan beri gemiler deniz ulaşımının önemli unsurlarından biri olmuştur. Ticari amaçlı olan gemilerin yanı sıra gezinti amaçlı gemiler de bulunmaktadır. Yelkenli gemilerin denizlerde ilerlemelerinde rüzgâr gücünden önemli ölçüde yararlanılır. Rüzgâr gücünden en üst seviyede yararlanması için yelkenlerin şekli önemlidir.

Yandaki fotoğrafı inceleyiniz. Sizce üçgen ve dörtgen şeklinde yelken kullanılımasının avantajları nelerdir?

Başka geometrik şekillerdeki yelkenler kullanılabilir mi? Neden?



Translation:

Types of Triangles, and Rectangles

Ships

Ships have been one of the most important components of water transportation since the ancient times. There ships for excursion as well as merchant ships. Wind power is used considerably in moving sailing ships in the sea. The shape of the sails is important to benefit from the wind power at the maximum level.

Study the picture. What are the advantages of using triangular and rectangular sails in your opinion?

Can you also use sails in other shapes? Why/why not?

Figure 3. A sample for comparative advance organizers in the learning domain of geometry and measurement

Figure 3 is an example for comparative advance organizers used on page 226 in the course book. This is at the beginning of processing the gains stated as “*Producing triangles according to their angles and sides and classifying the different triangles according to the properties of their sides and angles*” and “*Determining the basic elements of a rectangular, parallelogram, rhombus and trapezoid and drawing them*”. Students learn the concepts of triangle and rectangular at primary school; and the gains at 4th grade also include labelling the sides and corners of a triangle, a square and a rectangular, identifying the properties of sides and labelling the sides according to their length (MoNE, 2013, 2017). The question “*What are the advantages of using sail in the shape of a triangle or a rectangular in your opinion?*” is for attracting attention in relation to the first gain to be processed and the question “*Can sail in other shapes be used?*” is for emphasising the second gain to be processed. Yet, no associations are set up with the second gain because students do not know about parallelogram, rhombus and trapezoid yet.

4. Conclusions

This study analysed the advance organizers included in the course book “Secondary School Mathematics Course Book 5”—which was prepared in accordance with 2017 secondary school mathematics curriculum—in terms of use, functions and forms. Organizers should be presented prior to learning points. In this way, students can remember the cognitive structures

where they code the new knowledge and they can code the new knowledge more easily and in a more organized way in the long-term memory (Erden & Akman, 1996, p. 175). Therefore, it may be said that advance organizers in the course book are at the beginning of gains to be processed and that they have been prepared in a manner to serve to the purpose. 56 gains are available in 5th grade mathematics course book and the number of advance organizers included in the book is 38. Thus, advance organizers at the rate of 67% of the number of gains are used in the book. Of the advance organizers, 12 are explanatory whereas 26 are comparative advance organizers. It was remarkable in this study that the number of comparative advance organizers enabling students to set up comparative associations between the newly learn knowledge and prior knowledge was greater. Gür & Kobak-Demir (2015) concluded that the number of comparative advance organizers was limited in the course book that they evaluated. It may be said that there are differences between these two studies. Nakiboğlu et al (2010), on the other hand, found that there was significant increase in the number of advance organizers used in the course books prepared according to 2007 curriculum and that both explanatory and comparative advance organizers were included in the books. Advance organizers are very important in order for students to be able to understand the objective of a course, to get ready to learn, to focus their attention on the material to be learnt, to concentrate on the subject; and they also make learning easier (Çakıcı & Altunay, 2006). This study concludes that in 11 out of 38 advance organizers associations are not fully set up with the gains. Setting up associations with the gains is important for advance organizers to fulfil their functions fully. On examining the functions of advance organizers used, it was found that 18 of them had the function of exemplifying, 17 had the function of informative explanation and 1 had the function of narration. Considering the fact that advance organizers should be included at the beginning of processing, 38 advance organizers in total were found in the book. In some cases, processing supports more than one gain. Yet, advance organizers are usually for one of the gains.

It is important that course books are involved in the learning and teaching process. Therefore, performing studies on advance organizers used in course books is important in that those instructional materials functions as source students can use efficiently. Özmantar et al (2017) state that course books are an instrument with high potential to shape in-class practices. For this reason, advance organizers used in those books should be prepared in a manner as to affect students' motivation in classes in positive ways. A general examination of advance organizers has shown that narration is used very little in advance organizers. It would be beneficial to be used within the advance organizers of narration and description that will provide them with permanence in students' mind for this grade level. In addition to that, it can be said that the advance organizers using emphasising, attracting attention, visualising and asking questions is very positively sides for 5th grade mathematics course book.

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