



LEVEL OF RECALLING AND FORGETTING MATHEMATICAL KNOWLEDGE IN THE FOURTH GRADES IN PRIMARY SCHOOLS

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Abstract

Studies revealed that students begin a new semester having forgotten a certain amount of the data that they acquired during the previous terms. This research aims at determining the rates of recalling and forgetting the mathematical relations in accordance with the units discussed during the lessons. A mathematic test which included 25 questions was prepared as an evaluative criterion and this test was applied to 528 students studying in 4th classes of 13 different primary schools. The frequency and percentages were calculated by checking the last test whether the students again answered the questions correctly that were asked in the first test. The results of the study indicated that subjects of the lessons could not be recalled at the same rate.

Key words: Learning, Teaching Mathematics, Recalling, Forgetting

İLKÖĞRETİM DÖRDÜNCÜ SINIFLARDA ÖĞRENİLEN MATEMATİK BİLGİLERİNİN HATIRLANMA VE UNUTULMA DÜZEYİ

Özet

Araştırmalar, öğrencilerin bir ders yılı süresince öğrendikleri bilgilerin bir kısmını yeni döneme başladıklarında unuttuklarını ortaya koymuştur. Bu araştırma, öğrencilerin bir ders yılında öğrendiği matematik dersi bilgilerinin, konulara göre hatırlanma/unutulma oranlarını tespit etmeyi amaçlamaktadır. Ölçme aracı olarak 25 sorudan oluşan matematik başarı testi hazırlanarak, 13 ilköğretim okulundaki 528 dördüncü sınıf öğrencisine uygulanmıştır. Öğrencilerin ön testte doğru yanıt verdiği sorulara, tekrar son testte de doğru yanıt verip vermediğine bakılarak bunun frekans ve yüzdeleri hesaplanmıştır. Araştırmada, konuların aynı oranda hatırlanmadıkları görülmüştür.

Anahtar Kelimeler: Öğrenme, Matematik Öğretimi, Hatırlama, Unutma,

Introduction

Learning period that begins with birth continues whole life. Nevertheless, student is in a constant learning of information, skills, habits and ways of conduct. Learning has been tried to be defined via different methods and theories. Feldman (1996) defines learning by means of behaviouristic approach as permanent change of behaviors constituted by experiences.

There are different factors affecting learning period. Becoming mature, former experiences, motivation, attention, active participation of the students, feedback, perceptual distinguishing, semantic association and conceptual classification are some of these factors. We can clarify some of these factors as: *Becoming mature* means individual's reaching to the ability of learning behaviour both mentally and bodily (Ulusoy 2002). *Former experiences* are the skills, knowledge and ways of conduct of individual adopted through learning in the earlier stages of an individual's life. These experiences affect individual's learning skills either in a positive or negative way. This is called transfer in learning (Eggen and Kauchak 2001). *Motive (motivation)* is the propulsive power directing behaviours and causing an increase in senses (exuberance, willingness). It also transfers energy and activates the organism in order to accomplish certain behaviours and fulfil some ambitions on certain occasions (Morgan, 2000). Feedback is the information reporting the perfections and imperfections during and at the end of the learning period (Basaran, 1998).

Recalling

Recalling is to convey the information to short-term memory from the long-term memory. Erden and Akman state that (1996) the issue of what kind of knowledge an individual bears in mind is not known since the data located in the long-term memory is in a passive condition. The data stored in the long-term memory through appealing to various coding systems is not stable. It is re-activated and used by taking back to the short-term memory when needed (in case the individual meets a stimulative which reminds certain knowledge or when individual desires). Each of the data in the long-term memory can not be recalled whenever the individual desires. It is recalled either very hardly or easily. Hence, there are some factors affecting recalling process along with the factors affecting learning period.

One of these factors is the coding process in order to place the data in the long-term memory. Data can not be recollected unless coded effectively. The abundance of the conditions and the other stimulants and the clarity of the used clues and the surroundings forming the scope make recalling a convenient procedure during the coding of the data for the first time and sending them to the long-term memory. Likewise, among the factors affecting recalling the types of learning productions are also effective. Recalling of the psycho-motor skills easier than that of the informative data is an example for this. Impeding backwards or forwards are some of the important elements affecting recalling. Newly learned data disrupts the earlier learned ones by confusing with the stored data. The hindering affect of the recently collected data, that is to say, recent data's making recalling the earlier data harder, is called backwards impeding. On the other hand, forwards impeding is formerly learned data's making learning and recalling harder by hindering the recently collected data (Senemoğlu, 2001; Arkonaç, 1998:).

Disrupting effect is among the factors decreasing recalling time. When the different data are related with the same clue, disrupting effect comes into being as the target data is also used with different clues. For example, when your private parking space changes

that you have been parking for one year, you may have difficulty in recalling the new parking space from your memory in earlier times. As you are using the former “parking space” clue so as to remember your parking space, when you try to recall the new parking place, your former image of the parking space is activated and thus it causes a disrupting effect. However, there is a way of compensating the disrupting effect. If various concepts are organised, these concepts will not have a disrupting effect on each other (Atkinson and others, 1995). Although stored correctly, a rarely used knowledge makes these connections weaker and it becomes harder to access the desired data units. The connections becomes much stronger in frequently used data units and accessing to the knowledge becomes both easier and much faster.

Forgetting

Forgetting can be defined as the opposite of learning, explains forgetting with four forgetting theories. The first is the atrophy theory. According to this theory, skills and knowledge not repeated and not used vanish in time and connections among the neurons become looser. In the second theory, which is the experimental disintegration or the deletion theory, forgetting occurs as a result of not repeating the unrewarded behaviours. In the third theory, forgetting becomes due to backwards or forwards impeding. In the fourth theory, forgetting occurs by oppressing the memories and repelling them to unconscious (Baymur, 1994).

Vester (1997), also explains forgetting in two ways: first, a complete forgetting (can not be recalled again) and the second, not being able to relocate the data. In the first, the data either vanishes in the sensory recording or can not be recorded by not transferring to the protein synthesis from the RNA matrix in the short-term memory. In the second type of forgetting, the data is recorded in the long-term memory and preserved through storing. However, the data is blocked because of some hindered cells and circuits. When the system is interrupted, the stimulus can not be conveyed to the cells and get blocked because the substances that are found in the synapses and called transmitters provide the conveyance of the stimulus among the cells. For example they may get blocked as a result of some memories or impressions which cause stress.

Ulgen (1997), who associates the recalling of the data after a while with the permanency of the data in memory, refers to “*hereditary reasons and IQ*” as factors affecting the permanency of the data (recalling). Since the capacities of the short and long-term memories are determined hereditary, memory efficiencies of people vary. Hence, recalling and forgetting are individual differences among people and vary in accordance with the development of the individual. Healy (1999) suggests those clues which empower recalling for all ages of people:

- To give a meaningful shape to the new material
- To use a different meaning as a recalling exercise
- To organize and categorize
- To rehearse (repeating the subject several times or imagining)
- To treat (like making up a story with the words that must be recalled)
- To use the visual memory or imitation strategies
- To relate the material with something already known
- To comprehend the connections among events

Students may not remember some parts of the knowledge that they learned in a term. It is natural to forget the learned knowledge in time. It becomes hard when one tries to recall a knowledge that neither used nor repeated in mind. Some researches concluded that students begin a new semester having forgotten a certain amount of the knowledge that they acquired during the previous terms. Bracey (2002), Abercrombie (1999), Ballinger (1995) Borman (2000 ve 2001), Davies ve Kerry (1999), Fairchild ve Boulay (2002), Feldman (2002), Kerry ve Davies (1998), Ray (2003), Sanderson (2002), Sharp (2000), Simon (1996), Stenvall (2001), Wintre (1986) and many other researchers studied the effects of the summer holiday on forgetting.

Studies indicated that upon beginning a new semester after a summer holiday, students could not perform their reading and mathematical skills as effectively as they did during the previous semester. Studies also pointed out that this lack of efficiency was more distinguishable in mathematical skills (Cooper,2003; Ari, 2005). The amount of forgetting is not the same for all of the teaching branches. So, the issue of forgetting in mathematics was observed as a necessary topic to study on. In this study it is purposed to determine the recalling and forgetting rates of the mathematical knowledge learned in accordance with the units.

Method

This study intends to determine which mathematical subjects that the students learned during a semester are much more recalled or forgotten. The model of the study is the scanning (relational scanning) model. The population of the study is formed by the private and state-run primary schools located in the central districts of the Ankara city. The sample of the study is constituted by 528 fourth class students at 13 primary schools. A mathematics test (which consisted of 25 questions) which included the subjects in the term of 2003-2004 elementary school programs was prepared. While developing the test, expert's opinions were taken into consideration in order to maintain the validity of content, and corrections were made in accordance with the expert's suggestions. A pre-test was prepared and the distinguishing sequences and the difficulty levels of each choice were measured. Questions with a low distinguishing level were partly or completely removed. The coherence (reliability) of the 25-question was also measured and it proved to be much reliable.

The achievement test was performed to the fourth class students at the end of 2003-2004 school year as the first test and the same test was performed again to the same students (fifth class students then) at the beginning of the 2004-2005 school year as the last test. In order to increase the validity of the data, the researcher was present in the class during the test and the students were provided with enough time to answer the questions. By doing so, it was provided that all the questions were answered. The analysis of the results was carried out via SPSS computer programme. By comparing the achievement points of the first and last tests it was tried to determine the rate of increase and decrease in the achievements of the students in various subjects. The frequency and percentages were calculated by checking the last test whether the students answered the questions correctly again that were asked in the first test.

Findings

The findings of the study were analyzed according to the units of the course. Questions for each mathematics unit are given in the table. Thus, it is intended to display the general

situation of the subject; even the recalling percentages for a certain unit were measured. In table 1, findings on the two questions about the subject of sets are displayed.

Table 1. Answers to the Questions about Sets

<i>Answers</i>	1 th Question		2 th Question	
	<i>F</i>	%	<i>F</i>	%
Correct	390	85	231	69
Incorrect	67	15	105	31

85% of 457 students answering correctly to the first question and 69% of 336 students answering correctly to the second question about the sets in the first test also answered correctly to the same questions in the last test. As to the table, approximately 77% of the students having answered correctly both of the questions also answered correctly to these questions in the last test. Most of the students remembered what they learned about sets. Therefore, it can be stated that the learning about sets is easily recalled and is partly forgotten.

In table 2, findings on the three questions about the ordinary numbers are displayed.

Table 2. Answers to the Questions about the Ordinary Numbers

<i>Answers</i>	1 th Question		2 th Question		3 th Question	
	<i>F</i>	%	<i>F</i>	%	<i>F</i>	%
Correct	436	88	344	77	305	75
Incorrect	58	12	103	23	100	25

88% of 494 students answering correctly to the first question, 77% of 447 students answering correctly to the second question and 75% of 405 students answering correctly to the third question in the first test also answered correctly to the same questions in the last test about ordinary numbers. Approximately 80% of the students having correctly answered all of the three questions also answered correctly these questions in the last test. It was observed that a great majority of the students answering these questions correctly could still know about this subject. Hence, it can be stated that the knowledge about ordinary numbers is much permanent and the students do not get any difficulty in recalling this subject.

In table 3, findings on the three questions about the fractions are displayed.

Table 3. Answers to the Questions about the Fractions

<i>Answers</i>	1 th Question		2 th Question		3 th Question	
	<i>F</i>	%	<i>F</i>	%	<i>F</i>	%
Correct	282	72	100	48	134	50
Incorrect	108	28	110	52	132	50

72% of 390 students answering correctly to the first question, 48% of 210 students answering correctly to the second question and 50% of 266 students answering correctly to the third question about the fractions in the first test also answered correctly to the same questions in the last test. Only 56.6% of the students having correctly answered to all of the three questions also answered correctly these questions in the last test. Nearly

half of the students could not recall their learning on fractions. In this respect, it can be stated that the students have difficulty in recalling their learning about fractions and this subject is much forgotten.

In table 4, findings on the two questions about the decimal fractions are displayed.

Table 4. Answers to the Questions about the Decimal Fractions

<i>Answers</i>	1 th Question		2 th Question	
	<i>F</i>	%	<i>F</i>	%
Correct	205	55	201	57
Incorrect	170	45	153	43

55% of 375 students answering correctly to the first question and 57% of 354 students answering correctly to the second question on sets in the first test also answered correctly to the same questions in the last test. As to the table, approximately 56% of the students having correctly answered both questions also answered correctly to these questions in the last test. Like with the fractions nearly the half of the students could not remember learning about decimal fractions. Therefore, it can be stated that the students have difficulty in recalling their learning about decimal fractions.

In table 5, findings on the two questions about addition and subtraction in fractions are displayed.

Table 5. Answers to the Questions about Addition and Subtraction in Fractions

<i>Answers</i>	1 th Question		2 th Question	
	<i>F</i>	%	<i>F</i>	%
Correct	391	82	287	72
Incorrect	86	18	111	28

As seen in the table, 82% of 477 students answering correctly to the first question and 72% of 398 students answering correctly to the second question on addition and subtraction in fractions in the first test answered correctly to the same questions in the last test. It is seen that most of the students who answered the questions correctly in the first test could still know about this subject. While it is seen in table 3 that the questions on specifications of fractions (such as simple fraction, compound fraction) are forgotten, here we can see that addition and subtraction in fractions are not forgotten on that amount. Therefore, it can be stated that the students do not have difficulty in recalling their learning about addition and subtraction in fractions.

In table 6, findings on the two questions about addition and subtraction in decimal fractions are displayed.

Table 6. Answers to the Questions about Addition and Subtraction in Decimal Fractions

<i>Answers</i>	1 th Question		2 th Question	
	<i>F</i>	%	<i>F</i>	%
Correct	94	38	75	38
Incorrect	154	62	122	62

38% of 248 students answering correctly to the first question and 38% of 197 students answering correctly to the second question on addition and subtraction in fractions in the first test answered correctly to the same questions in the last test. Approximately 38% of the students having correctly answered both questions also answered correctly to these questions in the last test. In table 4, it is observed that questions on specifications of decimal fractions are forgotten in the rate of 56%, and in table 6 it is seen that addition and subtraction in decimal fractions are much more forgotten. Hence, it can be stated that the students have much difficulty in recalling addition and subtraction in decimal fractions.

In table 7, findings and commentaries on the three questions about problems of multiplication are displayed.

Table 7. Answers to the Questions about the Problems of Multiplication

<i>Answers</i>	1 th Question		2 th Question		3 th Question	
	<i>F</i>	%	<i>F</i>	%	<i>F</i>	%
Correct	95	43	259	65	164	49
Incorrect	125	57	139	35	170	51

In the table it is seen that; 43% of 220 students answering correctly to the first question, 65% of 398 students answering correctly to the second question and 49% of 334 students answering correctly to the third question about the problems of multiplication in the first test answered correctly to the same questions in the last test as well. Only 52.3% of the students having correctly answered all of the three questions also answered correctly these questions in the last test. In other words, nearly half of the students forgot their learning on multiplication. Therefore, it can be stated that the students have difficulty in recalling their learning about this subject.

In table 8, findings on the three questions about problems of division are displayed.

Table 8. Answers to the Questions about the Problems of Division

<i>Answers</i>	1 th Question		2 th Question		3 th Question	
	<i>F</i>	%	<i>F</i>	%	<i>F</i>	%
Correct	157	52	64	37	90	38
Incorrect	146	48	108	63	144	62

52% of 303 students answering correctly to the first question, 37% of 172 students answering correctly to the second question and 38% of 234 students answering correctly to the third question about the problems of division in the first test also answered correctly to the same questions in the last test. Only 42.3% of the students having correctly answered all of the three questions also answered correctly these questions in the last test. Over half of the students could not remember their learning about problems of division. Forgetting is a little more (10%) than it is in problems of multiplication. It can be stated that the learning about this subject is fairly forgotten.

In table 9, findings on the two questions about meter and mass measurements are displayed.

Table 9. Answers to the Questions about the Metric System and Mass Measurement Units

<i>Answers</i>	1 th Question		2 th Question	
	<i>F</i>	<i>%</i>	<i>F</i>	<i>%</i>
Correct	132	47	149	52
Incorrect	147	53	136	48

47% of 279 students answering correctly to the first question and 52% of 285 students answering correctly to the second question on the metric system and mass measurements in the first test also answered correctly to the same questions in the last test. Approximately 49.5% of the students having correctly answered both of the questions also answered correctly to these questions in the last test, in other words, half of the students could not recall their knowledge about this subject. Hence, it can be stated that the students have much difficulty in recalling meter and mass measurements.

In table 10, findings on the two questions about meter, liter and time measurement are displayed.

Table 10. Answers to the Questions about Problems of Meter, Liter and Time Measurements

<i>Answers</i>	1 th Question		2 th Question	
	<i>F</i>	<i>%</i>	<i>F</i>	<i>%</i>
Correct	42	26	92	44
Incorrect	118	74	115	56

Only 26% of 160 students answering correctly the first question about problems of meter, liter and time measurements in the first test also answered correctly the same questions in the last test. In the table above, nearly half of the students could recall meter and mass measurements, while in this table only one fourth of the students could. Only 44% of 207 students answering correctly to the second question also answered correctly the same questions in the last test. Over half of the students could not recall their learning about meter, liter and time measurements. Therefore it can be stated that the students have much difficulty in recalling problems of meter, liter and time measurements.

In table 11, findings and commentaries on the two questions about graphics are displayed.

Table 11. Answers to the Questions about Graphics

<i>Answers</i>	1 th Question	
	<i>F</i>	<i>%</i>
Correct	239	65
Incorrect	129	35

65% of 368 students answering correctly to the first question on meter and mass measurements in the first test also answered correctly to the same question in the last test. As seen in the table, nearly two thirds of the students mentioned above answered correctly to this question. In other words, one thirds of the students could not recall their

learning on this subject. It can be stated that the students partly have difficulty in recalling their learning about graphics.

Conclusion and Discussion

It is natural to forget the learned knowledge in time. Students may not remember some parts of the knowledge that they learned in a term. There are different factors affecting forgetting level, just like there are factors affecting learning level. One of these factors is the subject or, in other words, the structure of the knowledge to be learned. Learning and forgetting levels vary in accordance with the individual differences. However, making a generalisation is possible. Below, it is discussed that at which level the mathematical subjects are recalled by the students after three months. It was observed that the students could not recall all subjects homogenously at the end of this period.

Most of the students answering correctly to the questions about sets and ordinary numbers also answered the same questions again right after three months. Thus, it was observed that knowledge about sets and ordinary numbers were not forgotten and easily recalled.

Nearly two thirds of the students answering correctly to the questions about graphics also answered the questions correctly by recalling their learning. Knowledge about graphics is much more forgotten than the knowledge about sets and ordinary numbers. Therefore, graphics should be studied intensively and the learning taught in the previous year should be reviewed at the beginning of the new semester.

While most of the students answering correctly to the questions about addition and subtraction also answered correctly in the second test, a bit more than the half of the students answered correctly to the questions about specifications of fractions (such as simple fraction, compound fraction). It was observed that specifications of fractions were much forgotten. However, addition and subtraction were not forgotten at the same amount. Hence, specifications of fractions should be intensified. Moreover, the specifications previously taught should be reviewed.

While more than half of the students could answer correctly for the second time to the questions about specifications of decimal fractions, the students who could answer again correctly to the questions about addition and subtraction in decimal fractions remained much less than half of the students. The situation of the fraction specifications is similar to that of decimal fraction specifications. Nevertheless, the circumstances in addition and subtraction change. Addition and subtraction in decimal fractions were much forgotten than addition and subtraction in fractions. Thus, decimal fractions should be intensified.

Virtually half of the students forgot their knowledge about problems of multiplication. Forgetting is more dramatic in the problems of division. More than half of the students could not recall what they had learned about the problems of division. While teaching the problems of division and multiplication, the subject should be emphasized and previous teachings should be reviewed before beginning to study a new unit.

Only half of the students could recall their learning about the metric system and mass measurement units. The problems of the metric system and mass measurement units could only be recalled by one fourth of the students. Problems of liter and time measurements, on the other hand, could not be recalled by more than half of the

students examined. Thus, meter, liter, and time measurements should be intensified via several examples about these subjects. Reviewing the previous learning on these subjects should not be neglected.

The study analyses students' forgetting their mathematical learning upon coming back to school after the summer holiday. In this respect, the units which are more likely to be forgotten in the summer holiday are determined. Precautions should be taken to make students repeat the subjects which are likely to be forgotten during the holiday.

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