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METACOGNITIVE SKILLS SCALE

YÜRÜTÜCÜ BİLİŞ BECERİLERİ ÖLÇEĞİ

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ABSTRACT: The purpose of this study is to develop a scale that can be used in measurement of the metacognitive skills. In the pilot study 55-item-scale was applied to 239 college undergraduates. After test and item analysis the number of the items is reduced to 30 and the "Metacognitive Skills Scale" was formed. According to factor analysis it has been found that the scale was unidimensional and explained 35.74% of the total variance by 30 items. In the pilot study Cronbach's Alpha Coefficient of Reliability was .94.

Keywords: Metacognition, Metacognitive Knowledge, Metacognitive Experience, Learning Strategies.

ÖZET: Bu araştırmanın amacı yürütücü biliş becerilerini ölçmede kullanılabilecek bir ölçme aracı geliştirmektir. 55 maddelik deneme formu 239 üniversite öğrencisine uygulanmıştır. Test ve madde analizlerinden sonra madde sayısı azaltılarak 30 maddelik "Yürütücü Biliş Becerileri Ölçeği" oluşturulmuştur. Faktör analizi sonuçlarına göre ölçeğin tek boyutlu olduğu ve 30 madde ile toplam varyansın %35,74'ünü açıkladığı görülmüştür. Ön deneme sonucu elde edilen güvenirlik katsayısı Cronbach Alpha 0,94'tür.

Anahtar sözcükler: Yürütücü Biliş, Yürütücü Biliş Bilgisi, Yürütücü Biliş Yaşantısı, Öğrenme Stratejileri.

1. INTRODUCTION

In order to be a member of the society, people should obey the rules of the society and carry out the needs of the role he or she undertook in the society. The rules that should be obeyed and the roles that should be played constitute the culture of the society. People get this culture by means of the education. "Education is making purposeful and aimed changes on one's behaviors by means of experience" (Ertürk, 1982, p. 12). If education is defined as the process of purposeful learning, in this process the changes that occur in behaviors by means of one's experiences are called learning (Senemoğlu, 2007, p. 86).

Gagne, Briggs and Wager (1988) think that the purpose of instruction, no matter how it happens, is to support the learning process. In order to design the curriculum in accordance with the student's learning level, it is important to arrange the learning events appropriate with the learning process that takes place inside of the students' brain during the learning.

Gagne et al. (1988) summarize the processes that occur during a single learning activity as follows: **Attention** sets the boundaries of the range and type of the perception of the incoming stimulation. **Selective perception** converts this stimulation to object features to store it in short term memory. **Rehearsal** obtains the permanence and the refreshment of the information stored in short term memory. **Semantic encoding** prepares the information for long term memory. **Retrieval**, a process that includes research, brings the information back to the short term memory or to the response generator. **Response organization** selects and organizes the reaction. **Feedback** informs the learner about his or her performance and starts the process of reinforcement. **Executive control processes** select and activate cognitive strategies that define all or one of the pre-arranged internal processes.

In addition to the learning phases cognitive learning theories emphasize executive **control processes**.. These are the processes of choosing and carrying out cognitive strategies about learning. This kind of control processes effects learners' cognitive processes.

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"Executive control system, in addition to the control of the learner's motivational processes, is a system that produces and carries out the directives executing all of the cognitive processes. These processes carried out by executive control system are called as **metacognitive strategies.** Awareness of one's own executive control system, in other words, awareness of one's own cognitive processes used in learning is called **metacognition** (Senemoğlu, 2007, p. 335)".

1.1. Metacognition

The term, metacognition, first came out as the result of a research on children's memory processes, carried out by Flavell and the others in 1970 (Flavell, 1979). The result of the research showed that younger children were poor in aspect of cognitive facts, in other words, in aspect of metacognitive skills. (Flavell, 1979; Inoue, 2000).

"While cognition is being aware of or understanding something; metacognition is, in addition to learning, being aware of and knowing how something is learned" (Senemoğlu, 2007, p. 336).

Flavell (1979) defines metacognition as "knowledge and cognition about cognitive phenomena and monitoring of one's own memory, comprehension, and other cognitive processes." Metacognition regulates cognitive activities from all aspects. Assessing and monitoring one's own memory capacity is also an example of metacognition (Flavell, 1985).

According to Senemoğlu (2007, p. 336) metacognition is "generally the knowledge of one's own cognitive system, its structure, its functioning; in other words, the awareness of one's own cognitive structure and the learning characteristics and the ability to monitor and regulate one's own cognitive processes." According to Gagne et al. (1988, p. 70), metacognition is the internal processes that employs cognitive strategies to monitor and control the memory and learning processes.

Metacognition is generally a dynamic process which constitutes the meta-structure of information processing and which actively participates in the information processing. Metacognition is a process which manages and controls the cognitive processes of attention, selective perception, storing in short term memory, encoding into long term memory and retrieval (Senemoğlu, 2007; Eggen & Kauchak, 2001; Irak, 2004).

Additionally, to obtain learning at a desired level, it is very important to improve metacognitive skills which control one's own learning processes. A person with improved metacognitive skills can; focus his or her attention on a learning unit; distinguish important or unnecessary information; know how to use strategies to keep the information in short term memory or to store in long term memory and to retrieve it when necessary; assess if learning is accomplished; make necessary changes in metacognitive skills depending on these experiences to be more successful at the following learning situations.

Among the many definitions of metacognition, the most important difference to be emphasized is between **metacognitive knowledge** and **metacognitive experiences.** While metacognitive knowledge is knowledge about; general strategies that can be used for completing different tasks, the situations these strategies can be used, learning units in which these strategies can be effective, and one's own learning characteristics, metacognitive experience is the processes of monitoring, controlling and regulation of cognition.

Additionally, metacognitive experiences involve cognitive processes which learners employ to monitor, control and regulate their awareness and learning. Metacognitive experiences may occur before, during or after a cognitive activity. If one realizes that he or she does not understand a text, he or she may try to overcome this problem by applying a method like; re-reading, reconsidering what he or she understood, continuing to read in order to find some information that might make it easier to understand, asking for help or changing the goal about the learning unit. (Flavell, 1979; Flavell, 1981; Flavell, 1985; Senemoğlu, 2007; Pintrich, 2002; Baker & Brown, 1980). In the light of metacognitive knowledge which one acquired through metacognitive experiences, one decides which strategy will be more effective and applies that strategy in order to attain the objectives related to a certain learning unit. Metacognitive knowledge is confirmed when the defined objectives are achieved as a result of the activity. Unless one can achieve the objectives, metacognitive knowledge is rearranged in the light

of recent metacognitive experiences. If the person decides that the applied strategy is not useful to achieve the objectives, then he/she employs a new strategy. As a result of this repetitive process the more metacognitive experiences one goes through, the more possible it becomes to decide accurately which strategy is necessary for the present situation.

Some people find some resemblance between the metacognitive processes and how a CEO of a company keeps the integrity between managers and decision makers. Metacognition is the executive power of learning. Metacognitive strategies manage the way the learner thinks and plans during a learning activity in the same way the CEO manages the company (Blakey & Spence, 1990).

While most students improve their metacognitive skills in time, some does not. Teaching metacognitive skills may increase students' success remarkably. Students learn to think about their own thinking processes and they may apply learning strategies to overcome learning difficulties.

Researchers state that there are differences between the metacognitive skills of the successful students and the rest. Students with high academic achievements have a higher tendency to have more metacognitive skills in comparison to other students.

Berliner (2008) states that the world of the future will be a world of VUCA which is an acronym formed by the words of Volatile, Uncertain, Complex and filled with Ambiguity. In 2008 the amount of new information is doubled every two years. Through the advances in information technologies and through the contribution of the internet, it is estimated that the amount of new information will be doubled every 72 hours by the year 2010.

It is quite obvious that traditional education will fail in this volatile world filled with ambiguity. Thus it is becoming crucial to teach students how to learn new information along with the information itself to enable them become successful. It is necessary to improve metacognitive skills to keep up with the world of VUCA both during the school years and after.

The aim of this research is to develop "Metacognitive Skills Scale (MSS)" to assess university students' metacognitive skills. This scale can be used to find learning difficulties associated with deficiencies in metacognitive skills. We hope that educators can use this scale to remedy these deficiencies and enable their students overcome learning difficulties.

2. METHOD

2.1. Research Design

Descriptive research method is used in this study. The data used in the scale development process is collected from 241 undergraduates. After the pilot study 55-item experimental scale is reduced and 30-item MSS is formed.

2.2. Sample

The experimental test form was applied to 2nd and 3rd grades of Division of Initial Primary Teacher Education (DIPTE) of Education Faculty at Hacettepe University. 241 students participated in the application. After the application, it is observed that 2 students left the 2nd and 3rd pages of the 3-page test form. Thus, the data analyzed consists of 239 students. "Kline (1994) emphasizes that to develop reliable factors a participant-group of 200 people is generally sufficient; and that this number can be reduced to 100 when the structure of the factor is plain and if the number of factors is low; but it is beneficial to work with a larger participant-group to obtain better results (cited in Büyüköztürk, 2002a, p.480)." Thus the number of the students can be accepted to be sufficient.

2.3. The Preparation of MSS

In the first phase of developing MSS, related literature is thoroughly studied. The structure of the scale is based on a model presented by Flavell (cited in Senemoğlu, 2007) which shows "The Factors Related to a Person's Regulation of Learning Activities."

As stated before; one decides which strategy will be more effective to attain the objectives related to a certain **learning unit** and applies that **strategy** in the light of the **metacognitive knowledge** derived from **metacognitive experiences**. Metacognitive knowledge is confirmed when the defined objectives are achieved as a result of the activity. Unless one can achieve the objectives, metacognitive knowledge is rearranged in the light of the recent metacognitive experiences (Senemoğlu, 2007, p. 338).

Since items were extracted from the related literature, they were checked for compatibility with the comprehension level of students. For this purpose, items were checked by a teacher from the department of Turkish Language and Literature for correctness and simplicity. Later, in order to support the validity of the scale, 5 students from the subject group of 2nd grade students of DIPTE read the items aloud to simplify the terms they had difficulty to understand.

In the next phase an item pool of 65 items was presented to 6 domain experts. In the light of their opinions the items were revised. The finalized test form included 55 likert-scale type items. The participants were asked to respond to each statement in terms of their own degree of agreement or disagreement. They were instructed to select one of five responses: strongly agree, agree, undecided, disagree, or strongly disagree. The items were arranged randomly in experimental test form.

The scale had 14 unfavorable items. For favorable questions the answer "strongly disagree" was 1 point; "disagree" was 2 points; "undecided" was 3 points; "agree" was 4 points; and "strongly agree" was 5 points. For unfavorable questions the answer "strongly disagree" was 5 point; "disagree" was 4 points; "undecided" was 3 points; "agree" was 2 points; and "strongly agree" was 1 points. The minimum score of the test was 55, and the maximum score was 275.

3. FINDINGS AND RESULTS

3.1. Analysis of the Data

Statistics related to the distribution of the scores from the experimental test is given in Table 1.

Table 1: Descriptive Statistics of the Experimental Test

N	239
Mean	204.24
Standard Error of Mean	1.62
Median	208.92
Mode	219
Standard Deviation	25.02
Variance	626.11
Skewness	-.70
Kurtosis	1.11
Range	157
Minimum	113
Maximum	270
Cronbach's Alpha Coefficient of Reliability	.96

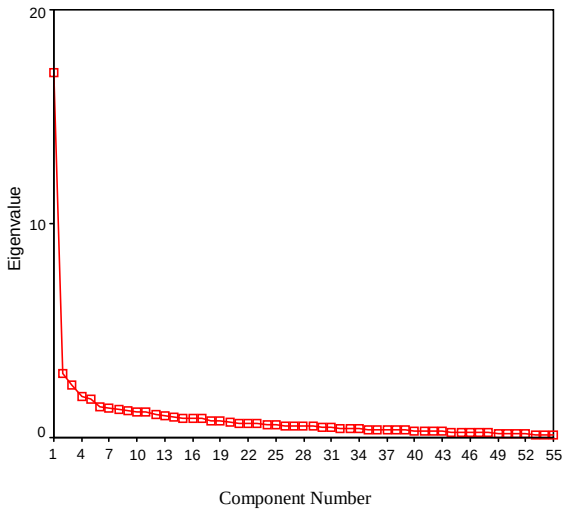
When Table 1 is examined, it can be seen that; variance is high; the distribution of scores has a large range; mean, median and mode values are approximate. This indicates that scores from the experimental test have a distribution which is close to the normal distribution. Cronbach's Alpha Coefficient of Reliability is calculated to be .96 and this value indicates that this scale has a high reliability for internal coherence.

Kaiser-Meyer-Olkin (KMO) test is conducted in order to find out whether the size of the study group is enough for factor analysis and a KMO value of .90 is found. Therefore it can be said that the KMO value of this study is very good. The result of the Bartlett test is 7102.39 ($p<.01$). This indicates that the variable we are measuring has multiple variables in universe parameter (Tonta, 2007).

Explanatory factor analysis proves that the scale is single dimensional. This is obviously seen in the line graph based on eigenvalues in Figure 1. According to Büyüköztürk (2002b), eigenvalues of 1

and above is included in the evaluation. But; as seen in the line graph, the factor with highly accelerated decreases gives us the number of important factors. Since the decrease here is in the first factor, the scale is unidimensional. Horizontal lines indicate that the eigenvalues of other factors are approximate. If we want to put one of these factors into evaluation, we must put all of them into evaluation.

Figure 1: Line Graph of Eigenvalues of Experimental Test



According to Büyüköztürk (2002b) important factors should explain 2/3 of total variance. But, Büyüköztürk (2002b) states that; in application, it is not possible to reach that amount, especially in behavioral sciences. He adds an explained variance of %30 or more should be enough in single factor scales. After the experimental test, it is observed that the scale explains %31,07 of total variance with one factor.

To test the validity based on internal criterion, the difference between the scores of the top and bottom groups of %27 from the test form is inspected. There is a meaningful difference between top and bottom groups ($t_{(126)}$=20.99, p<.01).

3.2. The Formation of the Ultimate Scale

In choosing the items that will be included in the ultimate scale, the factor loads, item test correlations and communalities of the items are studied. Büyüköztürk (2002b) suggests three criterions should be used in selecting items after factor analysis.

- Items with a factor load value of 0,45 or more should be selected,

- Items with a high load value in a single factor should be selected, (The difference between the factor load values should at least be .10).

- Items with communality approximate to 1.00 or above .66 should be selected (But it is very difficult in practice).

Additionally; Tezbaşaran (1996) suggests another way of choosing items; item analysis based on correlation. The correlation between each item-scale scores is calculated. The high correlation of an item with the test means that item measures whatever the whole test aims to measure.

In the light of these criterions and related literature, 30 items with a factor load of 0.44 or above are selected to form the ultimate scale. The ultimate scale with 30 items, 7 of which have an unfavorable statement, is given in table 3.

3.3. Estimation of the Statistics of the Ultimate Scale

To estimate the statistics of the ultimate scale, the raw data derived from the experimental test is used. For this purpose, descriptive statistics of the MSS with 30 items are estimated; examined by scale factor analysis; and item analysis based on correlation. The meaningfulness of the difference between the item and scale scores of the top and bottom groups of %27 is examined with a t-test.

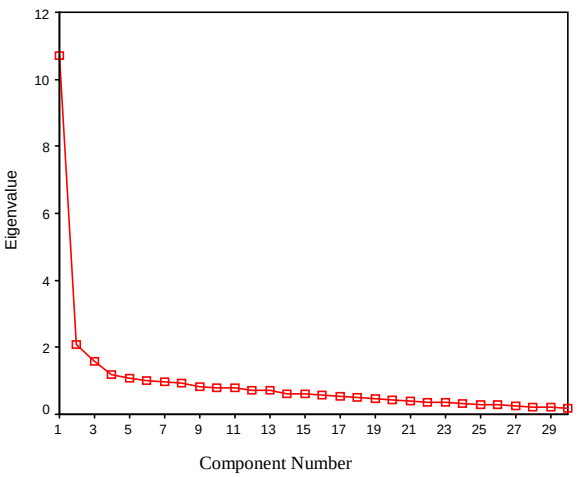
Statistics of the ultimate scale is presented in Table 2. It is observed that; variance is high; the scores have a large range; average, median and mode values are approximate. This indicates that the experimental test scores have a distribution which is close to the normal distribution. Cronbach's Alpha Coefficient of Reliability is calculated to be 0,94 and this value indicates that this scale has a high reliability for internal coherency.

Table 2: Statistics of the Ultimate Scale

N	239
Mean	112,22
Standard Error of Mean	0,96
Median	115,29
Mode	116
Standard Deviation	14,80
Variance	218,98
Skewness	-0,74
Kurtosis	1,25
Range	90
Minimum	60
Maximum	150
Cronbach's Alpha Coefficient of Reliability	0,94

Eigenvalue line graph of the ultimate scale is presented in Figure 2.

Figure 2: Line Graph of Eigenvalues of Ultimate Scale



When the line graph of the ultimate scale is examined, it is observed that the scale is single dimensional since there is a highly accelerated decrease in the first factor. Horizontal lines indicate that the eigenvalues of other factors are approximate. In addition to this, one factor explains %35,74 of total variance. The statistics of the ultimate scale is presented in Table 3.

Table 3: Statistics of the Items of the Ultimate Scale

Items	Factor Loads	Item-Test Correlations **	Communality	t The Difference Of Top&Bottom Groups % 27**
03. I use my previous experiences while organizing my new learnings	0,61	0,57	0,59	7,45
04. It is important for me to overview my learnings from time to time to determine how much and what I learned	0,56	0,52	0,63	7,48
07. I plan how and when to use the resources that will help me learn a subject well	0,62	0,58	0,46	8,82
08. I recognize my errors during learning process	0,58	0,54	0,44	7,49
10. If the learning couldn't be accomplished I search for other strategies that could be effective	0,67	0,62	0,45	9,78
11. I don't have an exact idea of how to organize my learning	0,59	0,56	0,61	8,40
12. While learning a subject, I am not aware of employing which strategy and how to use it	0,50	0,47	0,55	6,87
18. I know how much time I need to learn a subject	0,58	0,54	0,45	9,25
19. I revise my study plan that I used in learning and make necessary corrections	0,65	0,61	0,56	9,65
20. I check if I understood a subject during learning	0,66	0,62	0,67	6,73
24. When learning strategy that I used fails in learning process, I employ new one	0,68	0,65	0,52	8,81
26. I have difficulty in understanding the reason of the trouble I experienced during learning	0,44	0,41	0,55	7,43
28. I have difficulty in planning my learning a subject in accordance with my own learning qualities	0,63	0,60	0,65	9,82
29. I check if I effectively use my time during learning	0,60	0,56	0,67	8,00
30. I have difficulty in distinguishing important parts about a text or a learning unit	0,53	0,50	0,48	7,14
32. I search for the reasons of the failure while learning a subject	0,63	0,59	0,55	8,47
33. It is important for me to build meaningful relations between learned subjects during learning	0,53	0,49	0,52	6,40
34. I search for how I learned a subject most effectively while learning	0,68	0,64	0,64	9,23
35. I prepare the learning environment that is necessary for learning process	0,65	0,61	0,54	7,44
36. I critically make a plan before beginning to study a text	0,59	0,55	0,62	10,18
37. I revise and correct the learning strategies while studying a subject	0,61	0,57	0,71	10,05
38. I asses if the cognitive strategy that I employ has been successful or not	0,66	0,62	0,67	9,31
39. Till I reach a result, I organize the conditions for keeping my attention	0,64	0,60	0,53	9,03
41. I know which subjects I can learn easily and which I will have difficulty in learning	0,55	0,51	0,51	7,06
42. I don't spare much time for monitoring how much I learned about the subject during learning process	0,59	0,55	0,56	9,95
47. I know the other subject matters that I can use an effective learning strategy in a subject	0,65	0,62	0,45	7,85
50. I determine which learning strategy I should employ before I start studying	0,66	0,62	0,53	10,70
53. I know when I need to ask for help	0,52	0,48	0,47	5,40
54. During learning process, I have difficulty to determine in which conditions I can learn and those I have failed to learn	0,48	0,44	0,59	7,22
55. I determine what I will learn about a subject before I start studying it	0,52	0,48	0,48	7,73

**p<0,01

Table 3 reveals that factor loads of the items in the ultimate scale are between 0,44 and 0,68; item – test correlations between 0,41 – 0,65 ($p<0,01$); communalities between 0,44 – 0,71 and t values between 5,40 and 10,70 ($p<0,01$) that indicate there is a meaningful difference between the scores of the groups of top and bottom % 27. These findings signify that the scale is unidimensional and that each item measures whatever the whole test tries to measure. Tezbaşaran (1996) emphasizes that items that will be included in the scale should be able to distinguish between the scores of the top and bottom groups. t test values show that all items in the scale distinguish at an adequate level.

3.4. Validity of the Ultimate Scale

Content validity is supported by surveying related literature and by the opinion of specialists. Construct validity is tested with an explanatory factor analysis of data supplied from the test application. The information in Figure 2 and Table 3 shows that validity of structure is at a desired level. The test of the criterion validity of the ultimate scale is based on internal criterion. For this purpose, the difference between the scores from the groups of top and bottom % 27 is observed. There appears to be a meaningful difference ($t(126)=20,69$, $p<0,01$) between the groups.

4. CONCLUSIONS AND RECOMMENDATIONS

As a result of this research which aimed to develop a scale that can be used for measuring the metacognitive skills that an individual brings to a learning environment; a 30-item MSS in the type of likert scale is developed. It is based on the model of Flavell (cited in, Senemoğlu 2007) which shows "The Factors Related to an Individual's Regulation of Learning Activities" that consist of metacognitive knowledge, metacognitive experiences, learning unit (objectives) and learning strategies (actions). Analyses show the scale explains %31,07 of total variance with one factor. Related literature contains both unidimensional (Weissbein, 1996; Yurdakul, 2004), and multi-dimensional (Namlu, 2004; Schraw & Dennison, 1994, cited in Walters, 2002) versions of the scale developed by several researchers.

Items; 3, 10, 19, 24, 32, 34, 37, 38, are developed to determine the using level of individual's metecognitive knowledge and learning strategies he/she has. The learner who gets high grade from these items; can overwiev and rearrange his/her learning strategies during metecognitive experience (Gage & Berliner, 1984); knows he/she can use learning strategies in different disciplines and transfer them to the new conditions (Blakey & Spence, 1990); can decide to change his/her learning strategy with the effective ones when he/she failed to learn (Senemoğlu, 2007). All these activities take place during metacognitive experiences.

Items; 7,11,12,18,28,30,35,36,41,47,50,53,55, are developed to determine the level of the individual's knowledge about his/her own learning and learning unit. The learner who gets high grade from these items; knows which strategy he/she should choose for learning any subject matter and how to use it (Pintrich at al., 1987); knows limitations of his/her learning and memory capacity, how much time needed to learn a certain subject and how much he/she can learn in a specific time period (Ormrod, 1998, Cited in Hall, 2001; Blakey & Spence, 1990); critically makes a plan before beginning to study a text, retreives previos learnings about the subject matter by using appropriate strategies, organizes the learning materials, chooses the appropriate strategies consciously and can estimate the learning outcomes (Jackson, 2004; Gage & Berliner, 1984); can arrange the learning environment, distinguishing important parts about a text or a learning unit and knows when he/she need to ask for help in any diffuculty. Learner have this knowledge by the help of metacognitive experiences. The learning ways (including the knowledge about learning units and knowledge about how he/she can learn) are renewed and increased in amount by metacognitive experiences.

Items; 4, 8, 20, 26, 29, 33, 39, 42, 54, are developed to determine the level of individual's ability in planing and monitoring his/her learning, while monitoring, ability to decide wether he/she learned, and take measures for effective learning during metacognitive experiences. The learner who gets high grade from these items; monitors whether he/she can use the time affective, whether he/she

understand the subject deeply and judge the amount of knowledge he/she learned during learning period; can understand reasons of the failure while learning a subject. During learning process, he/she determines in which conditions he/she can learn and those he/she has failed to learn; till he/she reaches a result, organizes the conditions for keeping his/her attention; finds meaningful relations between the subjects learned, monitors his/her learning to judge whether learning take place or not and takes measures before the spending the time. These measures sometimes appear as changing the learning strategy, sometimes planing the time again, sometimes overwieving the previos learnings, some times searching different sorces or asking for help (Jackson, 2004; Gage & Berliner, 1984).

It is seemed above that the items are grouped as if into tree parts. But all these abilities measured are take place in an interactive manner during the metacognitive experience. All these activities form metacognitive experiences. Individual gains the knowledge about the learning unit and the suitable strategies by means of metacognitive experiences and forms his/her metacognitive knowledge. In all experiences this cycle last forever and renews and increase the amount of knowledge all the time. As all the items examined we believed that this scale is represent the metacognitive experiences in all aspects.

Researchers have found meaningful relations between metacognitive skills and academic achievement (Altındağ, 2008; Namlu, 2004; Ekenel, 2005; Gümüş, 1997; Vadhan & Stander, 1994). These findings show that students with less metacognitive skills will have less academic achievement. In order to increase the quality of education environment, it becomes important to know the levels of metacognitive skills of the learners'. By using the scale developed in this study, educators will be able to define the metacognitive skill levels of the students and take certain measures against the deficiencies. Additionally educators will be able to measure the effectiveness of the education applied or to compare the contribution of different curricula to metacognitive skills by using MSS.

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GENİŞLETİLMİŞ ÖZET

Öğretme-öğrenme sürecinin düzenlenmesinde, öğrenmenin nasıl gerçekleştiğini ortaya koymak önem kazanmaktadır. Öğrenmenin hangi koşullarda oluşacağını ya da oluşmayacağını açıklayan öğrenme kuramları iki ana grupta toplanmaktadır. Bu gruplar, davranışçı kuramlar ve bilişsel alan kuramlarıdır. Geleneksel davranışçılar, öğrenmeyi mekanistik açıdan görür ve incelerler. Uyarıcı ve davranım arasında bağ kurmayı temel alan bu kurama göre; öğrenci yaparak öğrenir; tekrar, öğrenmede gelişmeyi sağlar; ödül cezadan daha etkilidir; farklı örnek durumlar kullanarak öğrenme sonuçlarının daha geniş bir alana geçişini sağlamak önemlidir ve öğrenmede motivasyonel koşullar önemli rol oynar. Bilişsel alan kuramcıları, öğrenmeyi anlama ve kavrama süreçleri içinde incelerler. Öğrenme, bireyin zihinsel yapılarındaki değişmedir. Bu değişim, bireyin davranışlarında da değişmeyi ya da yeni davranışlar kazanmasını sağlamaktadır.

Bilişsel öğrenme kuramları, öğrenme aşamalarına ilave olarak yürütücü kontrolün de var olduğunu ileri sürmüşlerdir. Bunlar öğrenme ve hatırlamayla ilgili bilişsel stratejileri seçen ve işe koşan süreçlerdir. Bireyin kendi yürütücü kontrol sisteminin, diğer bir deyişle öğrenmede kullandığı kendi bilişsel süreçlerinin farkında olması da yürütücü biliş (metacognition) olarak adlandırılmaktadır.

Yürütücü biliş kavramı, 1970 yılında, çocukların bellek süreçleri ile ilgili yapılan bir araştırma sonunda ortaya çıkmıştır. Araştırma sonuçları, küçük çocukların bilişsel olgularla ilgili bilgisi, diğer bir deyişle, yürütücü biliş becerileri yönünden tamamıyla sınırlı olduğunu ve bellekleri, kavrama yetenekleri ve diğer bilişsel girişimlerini çok az izleyebildiklerini ortaya koymuştur.

Biliş, herhangi bir şeyin farkında olma, onu anlama iken yürütücü biliş, herhangi bir şeyi öğrenmeye ek olarak onu nasıl öğrendiğinin de farkında olma, nasıl öğrendiğini bilmedir. Yürütücü biliş genelde bilgi işlemenin üst yapısını oluşturan; bilgi işleme sürecine aktif olarak katılan dinamik bir süreçtir. Yürütücü biliş; dikkat, seçici algı, kısa süreli bellekte tutma, uzun süreli belleğe kodlama ve geri getirme bilişsel süreçlerini yöneten ve kontrol eden bir süreçtir.

Öğrencilerin çoğunun yürütücü biliş becerileri zamanla gelişirken bazılarınınki gelişmez. Yürütücü biliş becerilerini öğretme, öğrencilerin başarılarında dikkat çekici bir gelişme sağlayabilir. Öğrenciler kendi düşünme süreçleriyle ilgili düşünmeyi öğrenirler ve zor öğrenmelerin üstesinden gelmeyi sağlayacak öğrenme stratejilerini uygulayabilirler.

Bu araştırmanın amacı, üniversite öğrencilerinin, öğrenmede önemli bir yeri olan yürütücü biliş becerilerini ölçmek için "Yürütücü Biliş Becerileri Ölçeği (YBBÖ)" geliştirmektir. Bu sayede, öğrenmede problem yaşayan öğrencilerin yürütücü biliş becerileri ile ilgili eksiklikleri tespit edilebilecek ve elde edilen bilgiler ışığında, eğitimciler tarafından bu eksikliklerini giderecek önlemler alınabilecektir.

Bu araştırmada betimsel yöntem kullanılmıştır. Araştırmada kullanılan veriler 241 üniversite öğrencisinden toplanmıştır. Maddeler ilgili alan yazından alınarak oluşturulduğu için uygulamanın yapılacağı hedef kitlenin seviyesine uygun olup olmadığı araştırılmıştır. Bu amaçla, öncelikle maddeler bir Türk Dili ve Edebiyatı Öğretmenine okutularak Türkçeye uygunluğu ve sadeleştirilmesi sağlanmıştır. Daha sonra uygulamanın yapılacağı İSÖ 2. sınıf öğrencilerinden 5 kişiye sesli olarak okutulmuş ve anlaşılmayan kavramlar anlayabilecekleri şekilde tekrar sadeleştirilmiştir.

Sonraki aşamada 65 maddeden oluşan madde havuzu uzman görüşüne sunulmuştur. Görüşüne başvurulan 6 uzmanın tamamından dönüt alınmıştır. Bu görüşler ışığında maddeler tekrar düzeltilmiştir. Beşli likert tipinde hazırlanan ön deneme formunun son hâli 55 maddeden oluşturulmuştur. Deneme uygulamasından sonra 55 maddelik deneme formu 30'a indirilerek YBBÖ oluşturulmuştur.

Nihai ölçeğin istatistiklerinin kestirilebilmesi için deneme uygulamasından elde edilen ham veriler kullanılmıştır. Bu amaçla 30 maddeden oluşan YBBÖ'nin betimsel istatistikleri kestirilmiş, ölçek faktör analizine tabi tutulmuş, korelasyona dayalı madde analizi yapılmış, ölçek ve madde puanlarının %27'lik üst ve alt gruplar arasındaki farkın anlamlılığı t testi ile incelenmiştir.

Nihai ölçeğe ait istatistikler incelendiğinde; varyansın yüksek olması, puanların geniş bir ranjda dağılması; ortalama, ortanca ve mod değerlerinin birbirine yakın olması deneme uygulamasından elde

edilen puanların normal dağılıma yakın bir dağılıma sahip olduğunu göstermektedir. Güvenirlik katsayısı Cronbach Alpha 0,94 olarak hesaplanmış ve bu değer ölçeğin iç tutarlık anlamında güvenirliğinin yüksek olduğunu göstermektedir.

Açıklayıcı faktör analizi sonucu, nihai ölçeğin çizgi grafiği incelendiğinde, birinci faktörde yüksek ivmeli bir düşüş meydana geldiği için ölçek tek boyutludur. Yatay çizgiler diğer faktörlere ait öz değerlerin birbirine yakın olduğunu göstermektedir. Bunun yanında tek faktör ölçeğin toplam varyansının %35,74'ünü açıklamaktadır.

Nihai ölçeği oluşturan maddelerin faktör yükleri 0,44-0,68 arasında, madde-test korelâsyonları 0,41-0,65 arasında, ortak faktör varyansları 0,44-0,71 arasında ve % 27'lik üst ve alt grup puanları arasında anlamlı bir fark olduğunu gösteren t değerleri 5,40-10,70 ($p<0,01$) arasında yer almaktadır. Bu veriler ölçeğin tüm maddelerinin tek boyutta toplandığını ve her maddenin testin tamamının ölçtüğü özelliği ölçtüğünü göstermektedir. Üst ve alt gruplar arasında anlamlı bir farkın var olup olmadığını ölçmek için yapılan t testi sonucunda ölçek maddelerinin tümünün yeterli düzeyde ayırt edici olduğu görülmüştür.

Bireyin öğrenme ortamına getirdiği yürütücü biliş yaşantılarını ölçmeye yönelik bir ölçek geliştirmeyi amaçlayan bu araştırmanın sonucunda 5'li likert tipinde 30 maddelik "Yürütücü Biliş Becerileri Ölçeği" oluşturulmuştur. Yapılan analizler yürütücü bilişin tek boyutlu olduğunu göstermiştir. İlgili alan yazın incelendiğinde bazı araştırmacılar tarafından geliştirilen ölçeklerin tek boyutlu, bazılarının ise çok boyutlu olduğu görülmektedir. Ancak çok boyutlu ölçekler incelendiğinde ölçek maddelerinden bazılarının öğrenme stratejilerini ölçmeye yönelik olduğu görülmektedir. İlgili alan yazın incelendiğinde yürütücü biliş becerilerinin çok boyutlu olamayacağı görülmektedir. Yürütücü biliş tek bir yaşantıdır. Bu yaşantı yürütücü biliş bilgisi ışığında meydana gelir. Yürütücü biliş bilgisi olmadan yaşantı meydana gelemez. Bu nedenle yürütücü biliş yaşantısı ve bilgisini ayrı faktörler gibi algılamanın uygun olmadığı düşünülmektedir.

Araştırmacılar yürütücü biliş becerilerini ölçmek için çeşitli yöntemler kullanmışlardır. Ama araştırmacıların çoğu 4 ila 7 arasında seçeneği olan likert tipinde ölçekler geliştirip kullanmışlardır. Bu ölçek tercihleri hedef kitlenin öğrenim düzeyi ile doğrudan ilişkilidir. Okul öncesi dönemde gözlem yapmak uygun olabilir ancak orta öğretim ve yüksek öğretimde likert tipi evrensel ölçeklerin kullanılmasının yansızlık açısından önemli olduğu düşünülmektedir. Bu nedenle bu araştırmada geliştirilen YBBÖ'nin yansız ölçümlerin yapılabilmesi için alan yazına büyük bir katkı sağlayacağı düşünülmektedir.

Araştırmacılar yürütücü biliş becerileri ile akademik başarı arasında da anlamlı ilişkiler bulmuşlardır. Bu nedenle öğrenenlerin yürütücü biliş beceri düzeylerinin tespiti öğretim ortamının kalitesini artırmak açısından önemli hale gelmektedir. Geliştirilen bu ölçek kullanılarak hedef kitlenin yürütücü biliş beceri düzeyleri belirlenebilir ve ortaya çıkan eksiklikler ilave tedbirler alınarak giderilebilir. Ayrıca uygulanan eğitimin etkinliğini ölçmek ya da farklı eğitim programlarının yürütücü biliş becerilerine katkısını karşılaştırmak için de bu ölçek kullanılabilir. Sonuç olarak geliştirilen ölçeğin özellikle orta öğretim ve yüksek öğretimde yürütücü biliş becerilerini ölçmede etkin olarak kullanılabileceği değerlendirilmektedir.

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