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INVESTIGATION OF THE OBJECTIVES OF THE INFORMATION TECHNOLOGY AND SOFTWARE COURSE ACCORDING TO THE REVISED BLOOM TAXONOMY[i]

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Abstract:
The aim of this study is to evaluate the objectives in information technology and software course curriculum according to revised Bloom taxonomy. For this purpose, objectives of the fifth and sixth grade information technology and software course curriculum, which was started to be implemented in 2018, were examined. In the study, document analysis technique which is one of the qualitative research methods was used. Two-dimensional analysis table prepared by Anderson and Krathwol was used. In the data processing process, the objectives were evaluated separately by two researchers by using co-observer forms. The classified objectives were shown in tables and graphs and frequency and percentage values were given. There are 75 objectives at the 5th grade level and 77 objectives at the 6th grade level in the information technologies and software curriculum. According to the results of the analysis, it has been concluded that the objectives in the information technology and software course curriculum are under the understanding and applying dimensions in the cognitive process. It has been observed that most of the objectives are under the procedural and conceptual dimension. When evaluated in this respect, it has been concluded that approximately 90% of the objectives are at the higher cognitive level. In the course of information technologies and software, it is aimed to educate individuals who think actively, have problem solving and computational thinking skills, can follow and evaluate the reasoning process, carry out studies on product design and management, develop innovative and original projects that produce solutions to problems encountered in daily life, it is thought to be beneficial to increase the objectives towards developing high level cognitive skills.

[i] This study is the extended version of the proceeding represented on International Black Sea Coastline Countries Symposium III, October 18-20,2019, Zonguldak, Turkey.
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Keywords: revised Bloom taxonomy, information technologies, software curriculum

1. Introduction

The main purpose of our education system is to educate individuals with knowledge, skills and behaviors integrated with our values and competencies. At this point, it can be said that information society necessitates individuals to be information literate (Dursun, & Çuhadar, 2009). The curriculum organized for these purposes continue to be developed and updated with the rapid changes in science, technology and communication. Demirel (2011) states that the curriculum covers all activities aimed at the learner in order to realize the aims of the national education and the institution in an educational institution. Due to the limited time allocated for educational activities, it is necessary to identify the most important features among the desired outcomes. Different taxonomies have been developed to classify the objectives of the curriculum. The cognitive domain of Bloom Taxonomy, published by Bloom et al. ın 1956, consisted of six basic levels: "knowledge, comprehension, application, analysis, synthesis and evaluation. In the revised taxonomy, the cognitive domain consists of two dimensions as the knowledge dimension and the cognitive process dimension. The fact that the one-dimensional structure in the first taxonomy could not respond to new developments and remained inadequate in the field of cognitive processes necessitated the change. The reason of the Bloom taxonomy revision is that the old version of the taxonomy was insufficient to measure the high thinking skills, that it investigated the objectives only under one dimension and constructivist approach has become important (Tutkun & Okay, 2012). It is stated that the renewed Bloom taxonomy with its two-dimensional structure will facilitate classification in teaching planning and evaluation of the process (Zorluoğlu et al., 2017). Bloom is not the only one to classify human thought. However, what makes the taxonomy developed by him is important that it is simple and understandable (Turan, 2013). The first form of taxonomy consisted of 6 dimensions. Inability to measure high-level skills is among the reasons for the renewal of taxonomy (Tutkun and Okay, 2012).

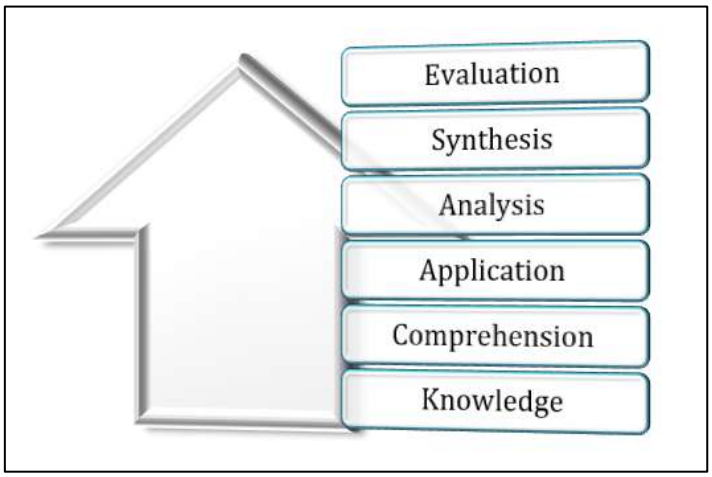

Figure 1: The Cognitive Domain of Bloom Taxonomy

The steps of Bloom taxonomy in cognitive domain are as knowledge, comprehension, application, analysis, synthesis and evaluation. The taxonomy developed to make the assessment activities feasible has been renewed to adapt to today's conditions. In renewed taxonomy, hierarchical sorting has been replaced by a more flexible structure. According to Arı (2013), it was easier to write objectives with renewed taxonomy. Performance evaluation can also take place in the process. The dimensions of the renewed taxonomy are shown in the table.

Table 1: Dimensions of Renewed Taxonomy of Cognitive Area

Knowledge Dimension	**Cognitive Process Dimension**					
	Remembering	**Understanding**	**Applying**	**Analysing**	**Evaluating**	**Creating**
Factual						
Conceptual						
Procedural						
Metacognitive						

(Anderson ve Krathwol, 2014).

The cognitive dimensions and steps of taxonomy listed above by Anderson and Krathwol (2014) can be expressed as follows:

A. Knowledge Dimension

It is seeked answer for what will be taught to the students under the knowledge dimension and it consists of four steps:

a. **Factual Knowledge:** It is the basic information about a subject area. This includes basic behaviors related to understanding, using and expressing this information. There is usually a low level of abstraction.
b. **Conceptual Knowledge**: It includes information about relationships between concepts and how these relationships are established.
c. **Procedural Knowledge:** Information about how any action or work should be done. It contains information about when and under which conditions different operations will be used.
d. **Metacogntive Knowledge:** It is the information that an individual can provide control over and related to his / her cognition.

B. Cognitive Process Dimension

It is seen that cognitive process dimension is based on constructivist approach. The transfer of learned knowledge is at the forefront. The aim of the course is to make the student active and meaningful learning. The steps in the cognitive process dimension are:

a. **Remembering**: Retrieving information in long-term memory.
b. **Understanding**: Verbal or written education messages are restructured by the student and expressed in their own sentences.
c. **Applying:** It is the process of problem solving, application and practice about the information that the individual has learned.
d. **Analysing:** It is the process of determining the part-whole and whole-part relationship.

e. **Evaluating:** It is the process of reaching the judiciary according to certain criteria.
f. **Creating:** It is the process of assembling parts in order to create a meaningful and functional new product.

The classification made using these taxonomy dimensions facilitates the implementation stage for the instructors and facilitates the planning and evaluation of the instruction for the curriculum development specialists. The classification of objectives provides advantages for teachers in different ways. (Anderson and Krathwohl, 2001; Bümen, 2006; Gökler, Aypay and Arı, 2012; Zorluoğlu et al. 2016):

- Allows to analyze the objectives from a student's perspective.
- It enables teachers to see the process from the point of view of students.
- Classification facilitates how teachers and teachers should present topics and concepts related to objectives, while at the same time helping the student understand more easily.
- It provides easy answers to questions and problems related to learning.
- It helps the teacher see the dimension of knowledge and cognitive process as a whole.
- It gives the teacher an idea of what the assessment questions should be.
- Classification helps the teacher in the implementation and evaluation of the curriculum.

In the taxonomy developed by Bloom, Anderson and Krathwohl thought that the one-dimensional analysis of the objectives was insufficient, and the taxonomy was complex (Tutkun and Okay, 2012; Zorluoğlu, Kızılaslan & Sözbilir, 2016). In this context, it is thought that it is more useful to examine the gains from the two dimensions of knowledge and cognitive process at the same time in order to obtain in-depth information about the objectives and to minimize the complexity (Anderson and Krathwohl, 2001). In order to keep pace with the developments in the learning and teaching processes, there was a need to make some adjustments in the original Bloom Taxonomy. In the revised taxonomy, the rigid hierarchical order is made flexible and the categories are made more contiguous.

In addition, the terminological and structural innovations in the renewed Bloom taxonomy have facilitated the planning process and objective writing of the teaching as well as enabled the evaluation of performance in the evaluation process (Tutkun, Demirtaş, Arslan, Gür-Erdoğan, 2015). It is emphasized that teachers and students are active in the measurement and evaluation process and multifocal evaluation in the Information Technologies and Software Course Curriculum (MEB, 2017). Considering the current situation, it is observed that the information technologies and software course is compulsory for 2 hours a week in the 5th and 6th grades of secondary schools, while it is also included in the elective courses 2 hours a week in the 7th and 8th grades. In our country, the Information Technologies and Software course has been made compulsory in the 5th and 6th grades of the secondary school in order to enable the students to meet the information technologies applications at an earlier age and acquire the necessary competencies.

These objectives and explanations that define their limits point to a lean content with a perspective that provides integrity in the perspective of values, skills and competencies at the level of classes and educational levels. In this way, a total of curriculum has been created that directs the use of metacognitive skills, provides meaningful and permanent learning, has been associated with sound and previous learning, integrated with other disciplines and daily life around values, skills and competencies.

2. Method

2.1 Purpose of the Study

This study was carried out to examine the achievements in the Information Technologies and Software curriculum for 5th and 6th grades published by the Ministry of Education in 2017 according to the revised Bloom taxonomy.

2.2 Design of the Research

The method of the study is document review. The main purpose in document review is the analysis of written materials that contain information about the phenomenon or cases that are aimed to be investigated (Yıldırım & Şimşek, 2011). Document review is used as a stand-alone research method, especially in cases where direct interview and observation is not possible (Bowen, 2009). In this study, it was analyzed according to the revised Bloom taxonomy in order to reveal how the Information Technologies and Software Teaching Curriculum (grades 5 - 6) published in 2017 showed a trend according to the revised Bloom taxonomy. For this purpose, a total of 152 objectives in the program were analyzed in terms of cognitive domain steps of the revised Bloom taxonomy.

2.3 Analysis of the Data

In the first stage of the research, the curriculum to be examined by the researcher has been determined. Researchers and co-observers have examined Bloom's revised taxonomy in new and old version. Before starting the research, the objectives in the first unit of the 5th grade information technologies and software curriculum were examined according to the revised taxonomy by the researchers as a pilot stage. After this stage of the research, observation forms created by the researchers were evaluated by 2 co-observers. After the evaluation of the objectives and content by the researchers and co-observers, they were placed on an observer form according to the consensus and disagreement. The item which the co-observers disagreed on were sent to the co-observers to check if there would be any change. After the final forms from the co-observers were combined, the researchers identified the objectives and contents that were agreed or not by marking them in a new form and made a reliability analysis based on these findings.

After determining the items on which the observers stated consensus and disagreement, reliability calculation score, which was proposed by Miles and Huberman

(1994), was used to calculate the reliability coefficient of the study [Reliability = (Consensus) / (Consensus + Disagreement)]. As a result of the calculation, the reliability of the information dimension was 92% and the reliability of the cognitive dimension was calculated as 88%. Miles and Huberman (1994) state that the reliability calculation of 70% and above indicates that the research is reliable. The reliability scores (92% and 88%) obtained as a result of the calculations show that the study is reliable.

3. Findings

One of the 75 objectives at the fifth-grade level was not analyzed by excluding it because it has affective characteristics. 74 acquisitions were analyzed separately in terms of information dimension and cognitive process dimension. Different graphics are presented in order to better see how the distribution is realized according to the dimensions and sub-dimensions included in the revised Bloom taxonomy.

Table 2: Examination of 5th Grade Objectives in Knowledge Dimension

Knowledge Dimension	*f*	**%**
Factual Knowledge	10	13,5
Conceptual Knowledge	24	32,4
Procedural Knowledge	37	50
Metacognitive Knowledge	3	4,1
Total	**74**	**100**

As seen in Table 2, it was concluded that the 13,5 % of the objectives are under factual information, 32,4 % of objectives are under conceptual knowledge, 50% of the objectives are under procedural knowledge and 4,1% of the objectives are under the metacognitive knowledge.

Table 3: Examination of the 5th Grade Objectives in Cognitive Dimension

Cognitive Dimension	*f*	**%**
Remembering	4	% 5,4
Understanding	36	% 48,6
Applying	23	% 31,1
Analysing	5	% 6,8
Evaluating	3	% 4,1
Creating	3	% 4,1
Total	**74**	**100**

As seen in Table 2, it was concluded that the 5,4 % of the objectives are under remembering dimension, 48,6% are under the understanding dimension, 31,1% are under the applying dimension, 6,8% are under the analysing dimension, 4,1% are under the evaluating dimension and the rest 4,1% are under the creating dimension.

Table 4: Examination of the 5th Grade Objectives According to the Revised Bloom Taxonomy

Knowledge Dimension	Cognitive Dimension						Total
	1. Remembering	2. Understanding	3. Applying	4. Analysing	5. Evaluating	6. Creating	
Factual	3	7					**10**
Conceptual	1	22		1			**24**
Procedural		7	23	3	2	2	**37**
Metacognitive				1	1	1	**3**
Total	**4**	**36**	**23**	**5**	**3**	**3**	**74**

In Table 4, the objectives of the 5th grade are shown both under knowledge and cognitive dimension. It is seen that lower-level thinking skills (remembering, understanding, applying) are intense compared to higher-order thinking skills (analyzing, evaluating, creating), and in the knowledge dimension, conceptual and procedural knowledge types are intense compared to factual and metacognitive knowledge types.

77 objectives at the sixth grade are analyzed separately in terms of knowledge dimension and cognitive process dimension.

Table 5: Examination of the 6th Grade Objectives in Cognitive Dimension

Knowledge Dimension	*f*	%
Factual Knowledge	4	5,2
Conceptual Knowledge	27	35,1
Procedural Knowledge	33	42,9
Metacognitive Knowledge	13	16,9
Total	**77**	**100**

As seen in table 5, 5,2% of the objectives are under factual knowledge, 35,1 % are under conceptual knowledge, 42,9 % are under procedural knowledge and 16,9% of the objectives are under metacognitive knowledge.

Table 6: Examination of the 6th Grade Objectives in Cognitive Dimension

Cognitive Dimension	*f*	%
Remembering	3	3,9
Understanding	24	31,2
Applying	21	27,3
Analysing	4	5,2
Evaluating	14	18,2
Creating	11	14,3
Total	**77**	**100**

As seen in Table 6, it was concluded that the 3,9 % of the objectives are under remembering dimension, 31,2% are under the understanding dimension, 27,3% are under the applying dimension5,2% are under the analysing dimension, 18,2% are under the evaluating dimension and the rest 14,3% are under the creating dimension.

Table 7: Examination of the 6th Grade Objectives According to the Revised Bloom Taxonomy

Knowledge Dimension	Cognitive Dimension						Total
	1. Remembering	2. Understanding	3. Applying	4. Analysing	5. Evaluating	6. Creating	
Factual	3	1					**4**
Conceptual		22	1	1	3		**27**
Procedural		1	20	1	5	6	**33**
Metacognitive				2	6	5	**13**
Total	**3**	**24**	**21**	**4**	**14**	**11**	**77**

It is seen that lower-level thinking skills (remembering, understanding, applying) are intense compared to higher-order thinking skills (analyzing, evaluating, creating), and in the knowledge dimension, conceptual and procedural knowledge types are intense compared to factual and metacognitive knowledge types.

Chart 1: Distribution of Objectives in Cognitive Process Dimension by Grade Level

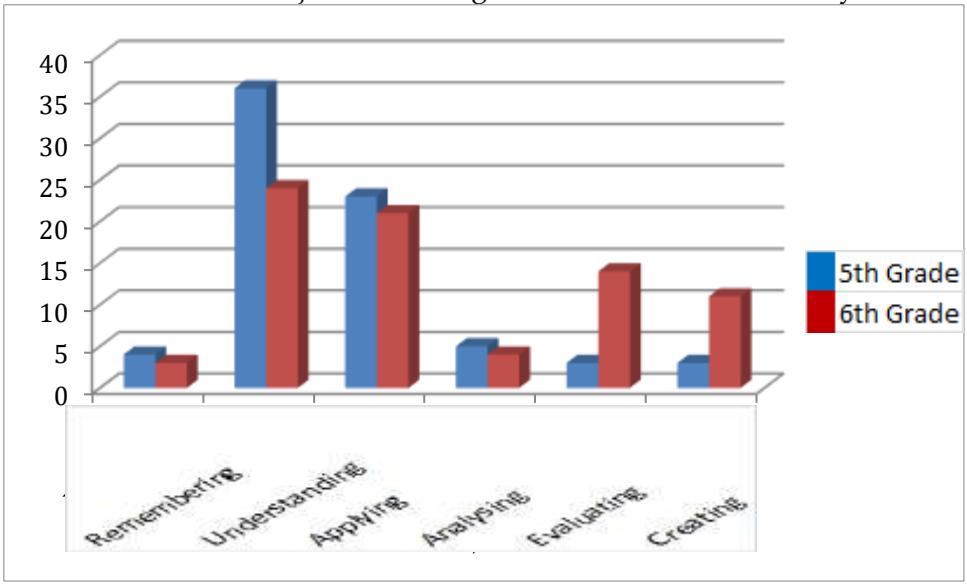

Chart 1 shows the general tendency of 151 objectives at the 5th and 6th grade levels of Information Technologies and Software Course Curriculum in the cognitive process dimension. It provides information to teachers, who are the practitioners of the program, on which of the sub-dimensions of the cognitive process dimensions of the subjects to be taught.

Chart 2: Distribution of Objectives in Knowledge Dimension by Grade Level

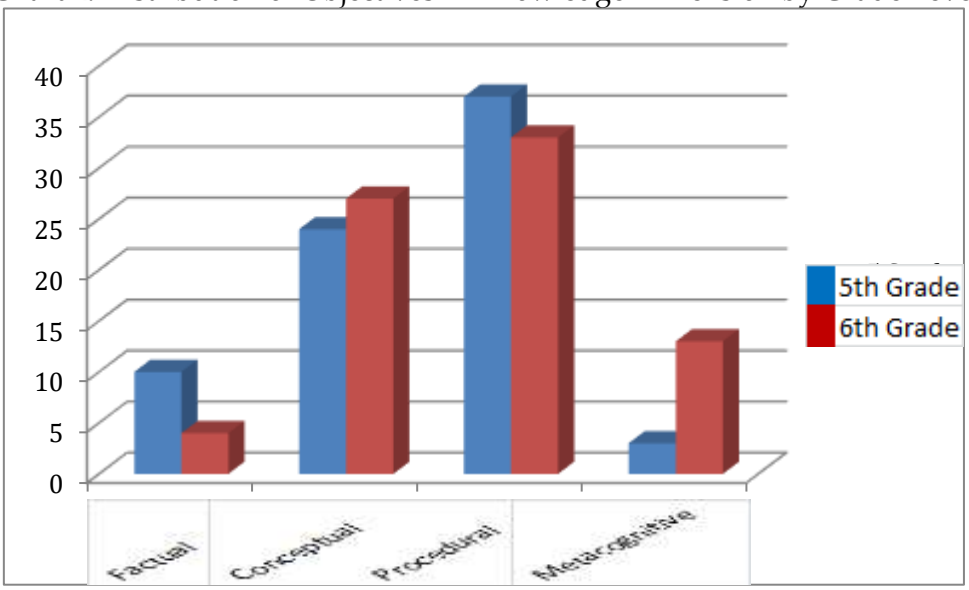

Chart 2 shows the general tendency of 151 objectives at the 5th and 6th grade levels of Information Technologies and Software Course Curriculum in the knowledge dimension. It provides information to teachers, who are the practitioners of the program, on which of the sub-dimensions of the knowledge dimensions of the subjects to be taught.

4. Conclusion, Discussion and Suggestion

According to the analysis results, it is seen that the objectives in the information technologies and software curriculum are mostly under the understanding in the cognitive process dimension, and then in the applying dimension. In the knowledge dimension, it is seen that they are mostly under the procedural then in the conceptual knowledge dimension. According to Anderson and Krathwohl (2001), objectives in an effective curriculum should be at a minimum level of understanding dimension. When evaluated from this point of view, it is seen that approximately 90% of the objectives are in the level of understanding and in the upper dimensions. According to Mayer (2002), the objectives in the dimensions of applying, analysing, evaluating and creating provide meaningful learning. This situation is expected to yield positive results in terms of the permanence of the learned knowledge. When these results are evaluated considering the grade level, it is thought that they will have a positive contribution to an effective teaching design. Here, it can be criticized that the objectives for the acquisition of high-level skills at the 5th grade level remain limited. However, it was concluded that the objectives at the 6th grade level had a more balanced structure in cognitive dimension. Achievements for effective learning should differ for subject areas and grade levels in the knowledge dimension steps (Anderson & Krathwohl, 2001).

During the learning process, students will be able to think at a simple level if they encounter low cognitive objectives and questions; and when they come across high cognitive objectives and questions, it leads to more mental activity, which forces students

to be more creative and questioning (Çepni, Ayvacı & Keleş, 2001). Similarly, in order for students to acquire high level cognitive skills, achievements and activities for high level cognitive dimensions should be presented (Aydın and Yılmaz 2010; Senemoğlu, 2001; Zorluoğlu, Kızılaslan & Sözbilir, 2016). From this point of view, it is expected that the accumulation in the cognitive dimension in the information technologies and software curriculum towards the upper cognitive steps will activate the students in the process. If this situation is viewed from a different perspective, it is emphasized that the objectives in the understanding level are insufficient in the transfer of knowledge (Anderson and Krathwohl). It is aimed to raise individuals who actively think, have problem solving and computing thinking skills, follow and evaluate the reasoning process, carry out studies on product design and management, develop innovative and unique projects that can produce solutions to daily problems in the information technologies and software lessons (MEB, 2017), it is considered to be beneficial to increase the objectives for developing high level cognitive skills. When the findings of the study are evaluated in general, it is thought that the curriculum objectives distribute equally in the knowledge dimension and therefore the curriculum is supportive of effective learning. However, considering the general distribution of the objectives in the knowledge dimension, it is thought that it will be beneficial to carry out improvement studies in the name of educating students who can do innovative and original studies.

In addition, the scarcity of studies on the subject of information technologies and software lessons in the literature is remarkable (Akbıyık, & Seferoğlu, 2012). Akbıyık and Seferoğlu (2012) conducted a research in order to reveal the situation related to how information technology lesson is handled and effected in different regions. According to information technology teachers, textbooks are mostly used in this research, demonstration and written instructions are followed in teaching software. In addition, information technology teachers stated that they could not complete the curriculum of the Ministry of Education due to the low duration of the course. As it is also indicated in the literature, the curriculum should be revised and developed according to the findings on the literature.

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