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The analysis of 9th grade chemistry curriculum and textbook according to revised Bloom's taxonomy

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Abstract

The aim of this study is to taxonomically analyse the 9th grade Turkish chemistry curriculum. A descriptive analysis method is used throughout the study. The document analysis is applied as a method to construct the codes and themes to reflect the results of the study. The results of the study exhibit that most of learning outcomes of the 9th grade chemistry curriculum focus on understand level (61%), and other levels of outcomes are remember (16%), apply (5%), analyse (13%), evaluate (0%) and create (5%). In addition, learning outcomes in the distribution of the cognitive domain are conceptual knowledge (79%), factual knowledge (16%), metacognitive knowledge (5%) and procedural knowledge (0%). The analysis of the textbook clearly shows that majority of the outcomes of units are based on conceptual knowledge and factual knowledge in particular units; however, the textbook has no learning outcomes as procedural and metacognitive in some units such as second, third and fourth units.

Keywords: Chemistry curriculum; revised Bloom's taxonomy; secondary science education;

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1. Introduction

Scholars are actively searching for ways to prepare children for the future. To help children develop the cognitive, academic, emotional and physical competencies to be successful in life, especially, in the twenty-first century, they should be supported in mastering both content and skills (Fasuga, Holub & Radecky, 2010). The term 'twenty-first century' has become an integral part of knowledge, skills and attitudes of the citizens which need to be able to fully participate in and contribute to the knowledge society that is believed to be critically important to success in contemporary careers and workplaces (Travers & Westbury, 1989). Whilst in the industrial society, the main focus of education has been contributing to the development of factual and procedural knowledge, and in the information or knowledge society, the development of conceptual and metacognitive knowledge is increasingly considered important (Anderson, 2008). Therefore, for the training of students who are a part of the information society and qualified to succeed in work and life in this new global economy, twenty-first century skills should be applied in all academic subject areas and in all educational, career and civic settings throughout the student's life (Reich, 1992). As a consequence, it is necessary to develop and implement curriculum and instructional strategies enhancing these skills (VanTassel-Baska, Bass, Ries, Poland & Avery, 1998).

A school curriculum is intended to provide children with the knowledge and skills required to lead successful lives (Gosper, Malfroy & McKenzie, 2013). Whilst curriculum consists of the knowledge and skills in subject matter areas that teachers teach and students are supposed to learn, instruction refers to the methods of teaching and learning activities which are used to help students to master the content and objectives specified by the curriculum (Achtenhagen, 2012; Pellegrino, 2010). Today, there is a growing interest that the taught curriculum needs to be redesigned. Teaching programs have many features such as the ability to change human life (Eseryel, Ge, Ifenthaler & Law, 2011). The use of the word 'transferability' and 'skill development' in discussions about the school curriculum practice has become widespread (Paas, Renkl & Sweller, 2003). Transferability is the understanding of the deeper structure of problem solution method to solve every kind of problem including real-life problem enabling students to transfer their knowledge and skills to new problems (Atlay & Harris, 2000; Chadha, 2006). Skill development refers to the way fostering an attitude of appreciation for lifelong learning and the way in which children learn, progress and become able to accomplish more complex tasks in different areas of their lives (Barthorpe & Hall, 2000; Davies & Farquharson, 2004; Northedge, 2003). The concept encompasses a wide-ranging and amorphous body of knowledge and skills defined as independent enquiry, creative thinking, reflective learning, teamwork, self-management and effective participation which are all parts of the basic element of twenty-first century curriculum design. Twenty-first century curriculum is defined as a new way of understanding the concept of 'knowledge', and a new definition of the 'educated person' is deemed to be essential for children's future productivity, prosperity and well-being in a changing world. Hence, designing and delivering the interdisciplinary, project-based and research-driven curriculum should be positioned at the forefront in preparing children for the new challenges of this century (Gosper & Ifenthaler, 2013; Gunes & Demir, 2007; Shulman, 1986). The National Science Teachers Association (NSTA) recommends that the science education community supports twenty-first century skills – embedded in student outcomes and defined as creativity, innovation, critical thinking, problem solving, communication, collaboration, personal responsibility, global awareness, social/intercultural skills, team learning and mastery of rigorous academic content – consistent with the best practices across a science education system, including curriculum, pedagogy, science teacher preparation and teacher professional development (National Research Council (NRC) 1996).

The science curriculum aims to foster understanding the natural and human-designed worlds, developing basic scientific ideas, understanding about the biological and physical aspects of the world, deep content knowledge through active intellectual engagement and emulating disciplinary practices and thinking and the processes through which they develop this knowledge and understanding (Bybee, 2010; Levy & Murnane, 2005; Roblin, Schunn & McKenney, 2018). The quality science inquiry-based curricula and support materials that promote science learning and twenty-first century skills also aim to foster the positive attitudes toward science and to encourage children to examine and appreciate how science and technology affect their lives and the environment (NSTA 2004). In Turkey, the science curriculum is designed to provide students with two essential types of ability, such as thinking like a scientist and acting like a scientist, and reflects a constructivist and collaborative approach. The new frameworks for skills and new curricular emphasise the importance of starting with children's own ideas and learning through interactions with objects and materials and their classmates to develop and maintain their own emotional, physical and mental well-being. Students can create new knowledge to learn about scientific concepts and to describe and explain the natural and physical world (Oliveira, 2009; Song, Wong & Looi, 2012; Wang, Wang, Tai & Chen, 2010).

Curriculum designers benefit from taxonomy to make sure that they are carefully aligned learning goals and outcomes, instructional strategies and assessment methods and tools. They commonly use Bloom's taxonomy to create learning outcomes, i.e., a way of defining different kinds of learning behaviours and attainments which we want to develop among students (Anderson & Krathwohl, 2001). Having an organised set of objectives and outcomes that are an expression of these objectives defined as descriptions of what students should know and/or be able to do, as well as designing of valid assessment tasks and strategies, and how well the students should attain these knowledge and skills to facilitate communication across persons, subject matter and grade levels (Anderson & Krathwohl, 2001; Krathwohl, Bloom & Masia, 1964).

The teacher, student and textbook presented by the curriculum are three main elements of the classroom teaching. The science textbook, considered as a reflection of the objectives and outcomes, always plays a central role in shaping what science is taught and, indeed, how it should be taught in classroom (Varol, 2017; Zorluoglu, Kizilaslan & Sozbilir, 2016). Curriculum developers prepare textbook in an excessively critical manner which fulfils the students' needs in all domains mainly the higher thinking skills and enhance the student achievement and success of curricula (Bumen, 2006; Sonmez, 1999). A systematic review of the outcome assessment cycle that includes planning, gathering, interpreting and using learning evidence to inform decision-making about improving educational programs is used for the information undertaken for the purpose of improving student learning and development (Palomba & Banta, 1999). The revised Bloom's taxonomy (RBT) consists of two dimensions such as cognitive process domain and knowledge dimension, which is used in the analysis of science curriculum. The cognitive process domain consists of steps of remembering, understanding, applying, analysing, evaluating and creating, whereas the knowledge dimension consists of factual, conceptual, procedural and metacognitive knowledge levels (Anderson & Krathwohl, 2001).

Bloom's taxonomy is mainly used in determining the outcomes of MONE in teaching curriculum in Turkey (Karaman, 2016; Kogce, 2005). For this reason, it is expected that the curriculum and textbooks developed according to outcomes should be compatible taxonomically. The chemistry textbook should be at the same level as the outcomes of the curriculum. The compatibility of outcomes and textbook at the same time affects the success of the students positively (Anderson & Krathwohl, 2001). In this study, the outcomes of the 9th grade chemistry curriculum and the chemistry textbook, which were applied for the first time in the 2017–2018 academic years, were analysed according to RBT. In addition, the compatibility between the outcomes of the chemistry curriculum and textbook was examined according to RBT to determine the effectiveness of the designed curriculum. Three researchers (two chemistry education experts and one curriculum expert) came together for the reliability analysis according to RBT.

2. Methodology

The study was conducted by using document analysis method. Document review is used to analyse written information about the subject that the researcher has examined without observing, observing or interviewing, to obtain information and to make sense (Bowen, 2009; Corbin & Strauss, 2008; Maykut & Morehouse, 1994).

In the study, the outcomes of the 9th grade chemistry curriculum and the analysis of the 9th grade chemistry textbook were made with the descriptive analysis. In the analysis, some theme-specific descriptions were used by the researchers (Day, 1993; Glesne, 2013). The study data were analysed according to RBT dimensions. The following steps were considered while the outcomes of the 9th grade chemistry curriculum and the 9th grade chemistry textbook were analysed independently:

The criteria for the analysis of 9th grade chemistry curriculum outcomes are as follows:

a) To form a common idea in the analyses, two outcomes from each of the first five units in the curriculum were randomly selected for joint analysis,
b) The researchers individually analysed the rest outcomes,
c) To reach a common judgement in the individual analyses, the researchers came together to determine conflicts and tried to provide a consensus by discussing the reasons of differences,
d) After the consensus was established, the dimension of the outcomes was determined,
e) The majority opinion was valid in cases where reconciliation could not be achieved,
f) Reliability of the outcomes analysis was made with the help of the differences in 'the consensus between researchers' and 'the disagreement between researchers'. The reliability of the analysis was calculated using the formula derived by Miles and Huberman, 1994. The reliability coefficient according to the calculation is calculated as 0.79

The criteria for the analysis of 9th grade chemistry textbook are as follows:

a) The textbook was reviewed in three parts according to RBT such as subject, activity and evaluation questions,
b) In the textbook, the parts that were not included in the activity and evaluation were examined as 'subject'. This section contained information on the subject. During the analysis of the subject section, texts were examined holistically and it was determined which level of RBT dimensions they were prepared for,
c) When there was more than one activity and evaluation question, the most preferred dimension was determined as the dimension of the relevant section. For example, in the evaluation section, there were nine evaluation questions. Five questions determined as B2 level, three questions as C2 level and one question as A2. When there were equal numbers of questions at the same level, the highest level according to RBT was determined as the dimension of the relevant evaluation section. For example, if there were nine evaluation questions, three of them were B2, three of them were C2 and three of them were A2, and the highest level, according to RBT (C2), was defined as the level of the relevant section.

3. Findings

The data collected through document analysis are presented findings. The analysis of the subjects, activities and evaluation questions of chemistry textbook and learning outcomes according to the RBT is reflected in this section. Data collected from RBT-based classification of the learning outcomes of the 9th grade chemistry curriculum are shown in Figures 1 and 2. There are totally five units in the chemistry course book. Analyses of these units according to RBT-based classification are shown in Figures 3 and 4. On the other hand, data collected from RBT-based classification of the subjects, activities and assessment questions in the 9th grade chemistry textbook are shown in Figures 5 and 6.

According to the analysis of the chemistry curriculum, most of learning outcomes of the 9th grade chemistry curriculum focus on understand level (61%). The distribution of learning outcomes in terms of the cognitive domain is as follows: understand (61%), remember (16%), apply (5%), analyse (13%), evaluate (0%) and create (5%). It can be concluded that the level of understand domain is more dominant within the outcomes of the chemistry curriculum.

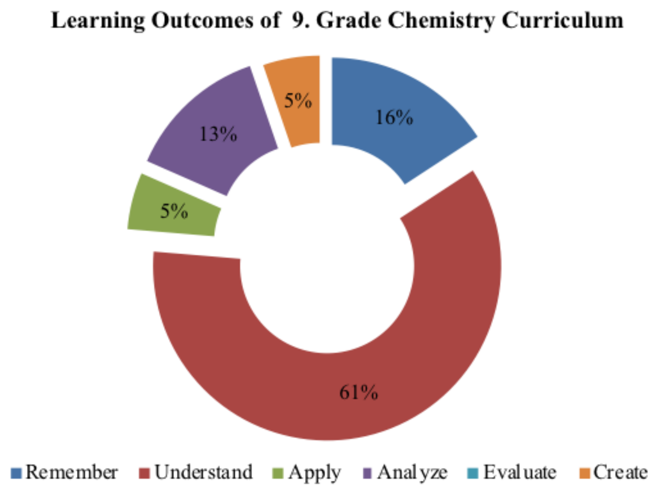

Figure 1. Cognitive domain analysis of the learning outcomes of the curriculum

As shown in Figure 2, according to the knowledge dimension analysis of 9th grade chemistry curriculum, most of learning outcomes focus on the conceptual knowledge dimension. The distribution of learning outcomes in terms of the cognitive domain is as follows: conceptual knowledge (79%), factual knowledge (16%), metacognitive knowledge (5%) and procedural knowledge (0%). As shown in figure, there is no outcome-related procedural knowledge dimension.

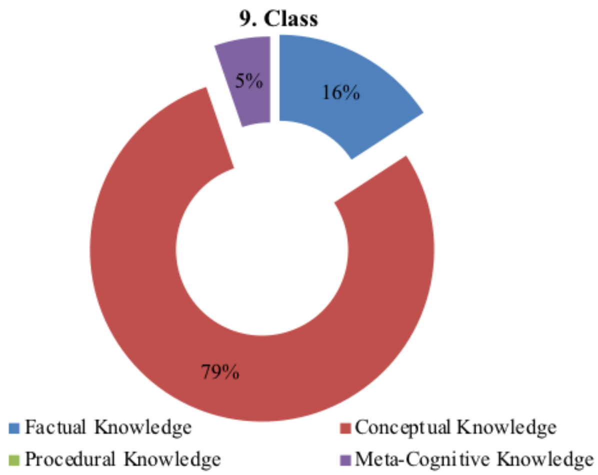

Figure 2. Knowledge dimension analysis of the learning outcomes of the curriculum

The unit-based analysis of the learning outcomes of the 9th grade chemistry curriculum in terms of knowledge dimension is shown in Figure 3. According to this, the majority of the learning outcomes of the first unit are focused on factual knowledge (86%) and procedural (14%) knowledge, and there are no learning outcomes related to conceptual and metacognitive in the first unit. On the other hand, all the learning outcomes of second, third and fourth units focus on conceptual knowledge. Unfortunately, there is no outcome at other knowledge dimension levels. Looking at the analysis of the fifth unit, it is found that the majority of the learning outcomes are at the conceptual knowledge dimension (60%). Only 40% of the learning outcomes are metacognitive knowledge dimension. Otherwise, the fifth unit does not consist of outcome at factual and procedural knowledge dimensions.

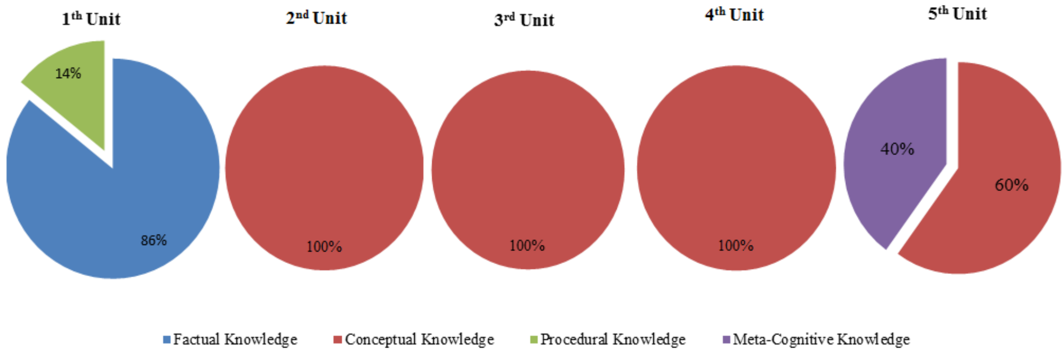

Figure 3. Unit-based knowledge dimension analysis of the curriculum

Analysis of the cognitive domain of the units is shown in Figure 4. As clearly shown in figure, the majority of the learning outcomes are focused on remember (57%) and understand (43%) domains, and the unit has no learning outcomes that focus, apply, analyse, evaluate and create domains at the first unit. Regarding the analysis of the second unit, the most learning outcome is related to understand (80%) domain. Only 20% of the learning outcomes are related to the analyse domain, and there are no outcomes at remember, apply, evaluate and create domains. The distribution of cognitive domains in the third unit is as follows: understand (55%), analyse (27%) and apply (18%). Considering the analysis of the fourth unit as shown in figure, 70% of the learning outcomes are related to understand domain, only 20% learning outcomes are at remember and 10% are at analyse domains. In other respects, there are no outcomes related to apply, evaluate and create domains. Finally, according to the analysis of the fifth unit, all of the learning outcomes are related to understand (60%) and create (40%) knowledge dimension. It has been analysed that there are no outcomes related to remember, apply, analyse and evaluate domains.

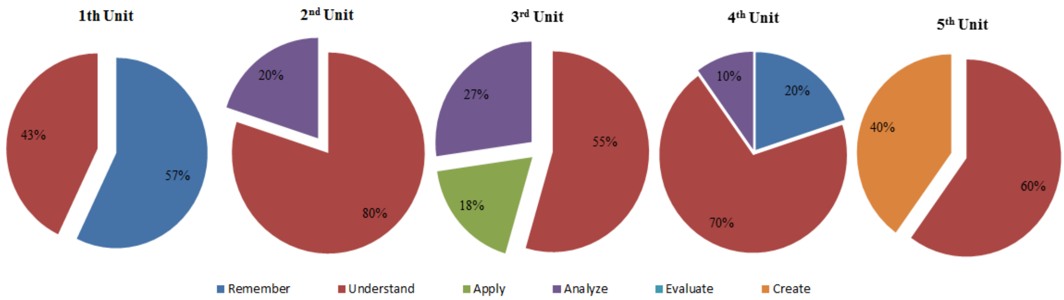

Figure 4. Unit-based cognitive domain analysis of the curriculum

The analysis of subject, activity and evaluation questions of the chemistry textbook in terms of the knowledge dimension is shown in Figure 5. As shown in figure, conceptual dimension is a prevalent dimension used in all fields of the chemistry textbook. According to subject field analysis of the chemistry textbook, the majority of the subjects focus on conceptual knowledge (76%) dimension. Similarly, procedural knowledge is 13% and factual knowledge is 11%. The analysis of the activities of the chemistry textbook according to RBT in terms of knowledge dimension is as follows: conceptual knowledge (47%), procedural knowledge (37%), factual knowledge (11%) and metacognitive knowledge (5%). Finally, the analysis of the evaluation questions at the end of each unit in chemistry textbook according to RBT in terms of knowledge dimension is as follows: conceptual knowledge (56%), procedural knowledge (11%), factual knowledge (25%) and metacognitive knowledge (8%).

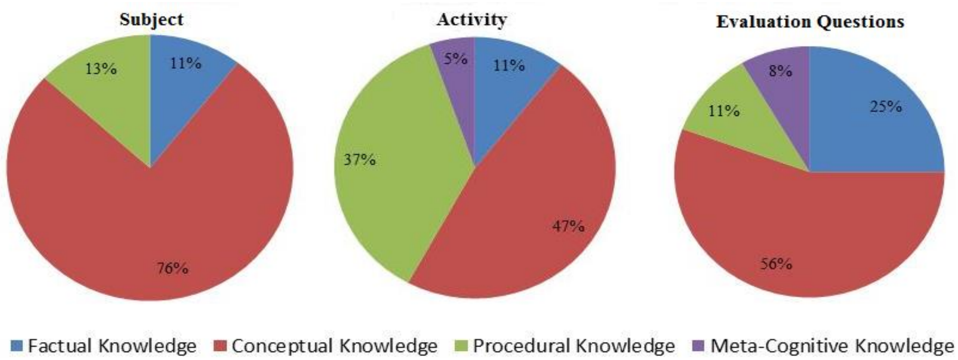

Figure 5. Knowledge dimension analysis of the chemistry textbook

The analysis of subject, activity and evaluation questions of the chemistry textbook in terms of the cognitive domain is shown in Figure 6. As shown in figure, understand cognitive domain level is dominant at subject field, whereas apply level and evaluate level are dominant at activity and evaluation question of the textbook, respectively. The distribution of cognitive domain analysis of the subject field of the 9th grade chemistry textbook is as follows: understand (74%), remember (8%), apply (5%), analyse (8%) and evaluate (5%). As shown in Table 1, cognitive domain analysis of the activities of the textbook is as follows: understand (16%), apply (42%), evaluate (16%) and create (26%). Consequently, the cognitive domain distribution of the evaluation question of the textbook has somewhat more favourable distribution. The distribution is as follows: remember (28%), understand (19%), apply (14%), analyse (3%), evaluate (31%) and create (5%). It can be deduced that cognitive domain distribution of the evaluation question defined as understand, apply, evaluate and create has close proportions.

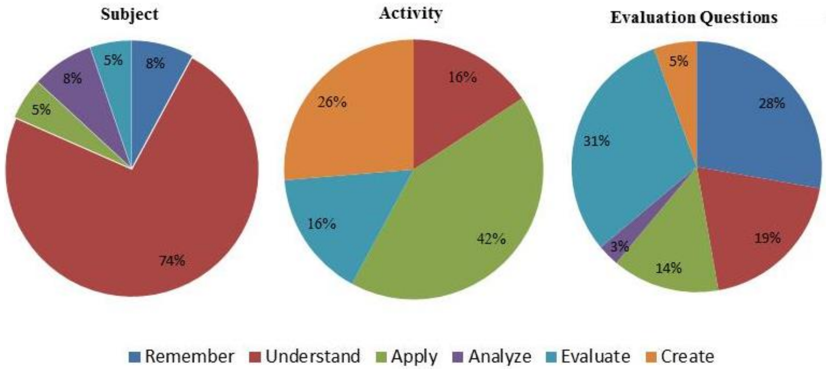

Figure 6. Cognitive domain analysis of the chemistry textbook

A dimension analysis of the subject, activity and evaluation questions of the chemistry textbook achieved in terms of the learning outcomes is shown in Table 1. As shown in Table 1, when we examine the relationship between subjects' dimension and learning outcomes, 86.8% are compatible with each other. In other words, 86.8% of the subjects are designed and prepared according to the learning outcomes. When the relationship between the activities and achievements is examined, it has been concluded that there is no activity related to 19 learning outcomes. For half of the learning outcomes, no activity is included in the textbook. Moreover, 42.1% of the activities are related to the dimension of learning outcomes. From the dimension analysis of the evaluation questions, it has been determined that the questions prepared for nine learning outcomes are at the lower level of the determined learning outcomes. It is about 23.7% of learning outcomes. In addition, there is no evaluation question for two learning outcomes (5.3%).

Table 1. Dimension analysis of the subjects, activity and evaluation questions in terms of learning outcomes

Learning outcomes	Outcome	Textbook	Activities in textbook	Evaluation questions in textbook
9.1.1.1	A2	A2↑	B3↑	A1↓
9.1.2.1.	A2	A2↑	A3↑	A1↓
9.1.3.1	A1	B2↑	B6↑	A1↑
9.1.3.2	A1	A1↑	–	A1↑
9.1.4.1	A1	A1↑	B2↑	B2↑
9.1.4.2	B2	B2↑	B2↑	A1↓
9.1.4.3	A1	B2↑	–	A1↑
9.2.1.1	B2	B1↓	A3↓	B2↑
9.2.2.1	B4	B2↓	B3↓	B4↑
9.2.3.1	B2	B2↑	B3↑	B3↑
9.2.3.2	B2	B2↑	–	B3↑
9.2.3.3	B2	B4↑	–	B3↑
9.3.1.1	B2	B2↑	–	B2↑
9.3.2.1	B2	B2↑	B2↑	B5↑
9.3.3.1	B2	B2↑	B3↑	–
9.3.3.2	B3	C3↑	C3↑	C5↑
9.3.3.3	C2	C2↑	–	C5↑
9.3.3.4	B3	C2↑	C3↑	C3↑
9.3.3.5	B2	B2↑	–	B5↑
9.3.4.1	B4	B4↑	–	B5↑
9.3.4.2	B2	C2↑	C5↑	–
9.3.4.3	B4	C2↑	–	B5↑
9.3.5.1.	B4	B4↑	–	B5↑
9.4.1.1	B2	B3↑	–	A1↓
9.4.2.1	B4	B2↓	–	B5↑
9.4.3.1	B2	B2↑	C5↑	B2↑
9.4.3.2	B2	B2↑	C6↑	B5↑
9.4.3.3	B2	B2↑	C5↑	B1↓
9.4.3.4	B2	B2↑	–	B5↑
9.4.4.1	B1	B2↑	–	B2↑
9.4.4.2	B1	B2↑	–	A3↓
9.4.4.3	B2	B2↑	–	C2↑
9.4.5.1	B2	B2↑	-	A1↓
9.5.1.1	B2	B2↑	B6↑	B1↓
9.5.1.2	D6	B2↓	D6↑	D5↓
9.5.1.3	B2	B2↑	-	B2↑
9.5.2.1	B2	B5↑	C6↑	D6↑
9.5.2.2	D6	B5↓	-	D6↑

↑: Equal to or above the learning outcome level, ↓: Equal to or below the learning outcome level,
-: No relationship

4. Discussion and Conclusion

When analysing the results of the 9th grade chemistry curriculum outcomes according to RBT, it has been concluded that the outcomes for each of the cognitive process dimensions are included. However, clearly, it is deducted that the outcomes are not distributed homogenously to each dimension of RBT. The results explicitly represent that the curriculum involved more outcomes in understanding the cognitive process dimensions than the outcomes in the apply and creation dimensions. However, then, different students have different cognitive process skills and they can learn in different ways; the outcomes which support teaching process need to be distributed at different dimensions (Noble, 2004). Although outcomes of the 9th grade chemistry curriculum do not have a homogeneous distribution in the cognitive process dimension, the curriculum consists of outcomes for each dimension of RBT. Nevertheless, the results represent that the curriculum emphasises on outcomes at lower-level cognitive process dimensions rather than higher-level cognitive process dimension stages. This situation demonstrates that the curriculum is structured to allow teachers implementing the curriculum to be involved in the processing of lower-level cognitive process dimensions (Anderson & Krathwohl, 2001). When the outcomes in the curriculum prepared for the lower-level cognitive dimensions, this leads that the curriculum practitioners also should be provided training for lower-level cognitive dimensions (Miller, 2004). To avoid such situations, the curriculum outcomes should be distributed homogeneously in the cognitive process dimensions or should be shifted to the higher-level cognitive dimensions in horizontal progression taking into account the spiral approach.

RBT is a taxonomy that allows teachers to differentiate curricula for those students possessing different characteristics (Noble, 2004). Preparing subject- and outcome-oriented curricula, both regarding different steps of cognitive process dimension and information dimensions, is a requirement for students to learn at different levels and to activate their mental processes. The 9th grade chemistry curriculum owns an outcome for every step of information dimension except operational knowledge; notwithstanding, as reflected above, the curriculum consists of mostly conceptual knowledge outcomes because of the outcomes not being distributed homogeneously in every step of the information dimension.

Anderson and Krathwohl (2010) declared that when the level of the classroom increases for the effectiveness of the curricula or when the units progress at the class, knowledge and cognitive level of the outcomes, that is to say, the first step of dimensions in the first unit at class level and the last step of dimensions as the units progress are expected to be increased. However, it is clearly deducted that the current curriculum outcomes do not overlap with this view in the information dimension. When examined by unit levels, respectively, the first unit presents empirical knowledge, the second is conceptual knowledge, the third is conceptual knowledge, the fourth is conceptual knowledge and the fifth is conceptual knowledge-based outcomes. The extent, in which outcomes in the first state are concerned with factual knowledge and the multiplicity of outcomes in conceptual knowledge in subsequent units, is partly parallel with information on the increase in the level of dimensions as the unit levels increase such as Anderson and Krathwohl (2001) representation. Outcomes in different dimensions should be included to increase the effectiveness of teaching and to ensure that the curriculum is different in terms of taxonomy (Krechevsky & Gardner, 1990). Accordingly, the outcomes of the 9th grade chemistry curriculum do not vary from the knowledge dimension stages to the conceptual knowledge.

Regarding the findings of the study, it should be suggested that the objectives should be enriched and improved. Aydin and Yilmaz (2010) emphasise on the point that it is possible for the students to identify the variables in the problem given to them in the science lesson, to construct hypotheses, to design the solution steps for the problems and to have higher-level cognitive processes, including the dimensions of RBT analysis, evaluation and creation. When examining the 9th grade units, it is obvious that higher-level cognitive process skills are included in different units without considering a specific hierarchy. When looking at unit-by-grade bases, by virtue of the fact that the outcomes in each unit are related to the comprehension level of cognitive process skills, it is also clear about that 9th grade outcomes that are not prepared to improve students' cognitive process skills.

Students could exhibit individual differences when assessing individual thoughts in terms of their definition and productivity (Talbot, Wylie, Dutilly & Nielsen, 2018). The activities and evaluation questions used in determining the cognitive skills of the students should be presented at different levels considering the individual differences of the students. However, lower-level cognitive processes based on remembering, understanding and memorising skills are presented for the students in the books and also by the teachers in the learning and teaching environment (Weiss & Pasley, 2004).

When the book is examined according to RBT in the subject, activity and evaluation questions' sections, the conceptual knowledge is based on the information dimension; in the cognitive process dimensions, understanding the application and evaluation questions is mainly based on the remembering level in the subject session.

In the subject section, no information is given about the metacognitive knowledge from the information dimensions to the creation dimensions and cognitive process dimensions. In the activity section, while having activity for each dimension from the information dimensions, there is no activity in the recollection and analysis step in the cognitive process dimensions. In the section of evaluation, there are evaluation questions for each dimension in the information dimension and cognitive process dimensions. Asking questions about lower-level cognitive processes, such as factual knowledge and recalling, may prevent students from thinking conceptually about science concepts (Kawalkar & Vijapurkar, 2013; Talbot et al., 2018). For this reason, clearly, it has been identified from the examination of the curriculum evaluation section that the evaluation questions prepared for the current curriculum have been prepared so as to activate students' higher-level thinking. In addition, the preparation of the activities in the book for higher-level cognitive process skills and providing conceptual and operational information-oriented activities than information dimensions enable the students to reinforce the concepts learned in the subject dimension.

Depending on the horizontal progression in the subject matter, activities and evaluation questions, the outcomes made for the stages of information and cognitive process dimension are expected to be hierarchical progression by steps or higher hierarchies by means of the upper dimensions (because of including other dimensions) (Anderson & Krathwohl, 2001; Harries & Botha, 2007; Semsar & Casagrand, 2017; Thompson & O'Loughlin, 2015; Verenna, Noble, Pearson & Miller, 2018).

Anderson and Krathwohl (2001) also indicated that it is supposed to establish a hierarchical structure between curriculum outcomes and subject matters, activities and evaluation questions. As a result, subject matters, activities and evaluation questions should be prepared considering the outcomes. For instance, if the outcome is considered to be at the level of comprehension of the cognitive process dimension, the subject matter, activities and evaluation questions should be prepared at the minimum level of understanding. In other words, the subject matter, activities and evaluation questions should be prepared at any level appropriate to any of the steps of understanding, applying, analysing, evaluating or creating; in this case, however, it can be stated that the curriculum is effective (Anderson & Krathwohl, 2001; Zorluoglu et al., 2016). In this respect, considering the outcomes of subject matter, activities and evaluation questions, taking into account the outcomes of the 9th grade chemistry curriculum, a majority (86.8%) of the matter of the subject is at or above the acquisition level, below the half of the activities (42.1%) is on the same level or higher than the outcome level and none of the activities are in the book for 19 outcomes; 71.1% of the evaluation questions are at the same level or higher than the outcome level.

To ensure the effectiveness of the curriculum, it is necessary that the 9th grade chemistry achievements and course books are compatible or hierarchical distribution according to RBT (Anderson & Krathwohl, 2001). In addition, the subject matter included in the books, taking into consideration the level of the outcome in the RBT, should be made necessary for the effectiveness of teaching matter, activities and preparation of the evaluation questions in a higher dimension than the size of in the RBT. In general, the 9th grade chemistry book provides Anderson and Krathwohl's (2001) necessities for effective teaching with the subject matter and evaluation questions except for the activities.

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