



A REVIEW OF TURKISH SCIENCE COURSE CURRICULUM IN TERMS OF SUSTAINABLE DEVELOPMENT GOALS

Mustafa Kemal YÜZBAŞIOĞLU, Mehmet Altan KURNAZ

Abstract: The aim of this research is to determine whether or not there is a consistent approach to science education with the correlation of sustainable development goals (SDG). Document review method is used in this study. In this study, 2018 curriculums learning outcomes are used as a resource. 58 of 302 learning outcomes in the curriculum are found to be related to SDGs. SDG related learning outcomes are reviewed by their distribution according to grade levels, curriculum's learning fields, lecture duration, related goals, and goal groups. As a summary science course curriculum have a deficiency in containing sufficient SDGs. Learning outcomes related to the low number of goals suggest that students are directed to specific goals. In order to achieve sustainable development, it can be recommended that these learning outcomes should be revised to fill the deficiencies of the curriculum. Studies can be conducted to determine whether the goals that are not included in the science course are found in other courses.

Key words: sustainability; sustainability education; sustainable development goals; science curriculum.

1. Introduction

The rapid increase in population, causes an increase in needs and demands. Due to limitations of natural resources, these needs and demands cannot be required and this situation will cause additional problems. Having limited resources as opposed to high demands, resulted in the birth of efficient growth ideas. Efficient growth ideas led to the foundation of sustainable development term (Baykal & Baykal 2008). Sustainable development is having met the needs of people today, and doing this without stripping future generations' ability to bolstering themselves (Alkis, 2007; Brundtland Report, 1987; Collin, 2004; WCED, 1987). On the subject of sustainable development, it can be seen that economists are emphasizing economical developments, politicians are emphasizing communal issues, and educators are emphasizing environment education. Although there are different parameters to define sustainable development, the major points are ecological sustainability, social and cultural sustainability along with economical sustainability (McIntyre, 1993). The focus point of all these key points is not to consume greater amounts than it can produce and provide. In literature the idea of, "future generations will inherit the world from existing society thus people should preserve, develop and left the world in the best possible way to future generations" is emphasized (Ozey, 2009; Tietenberg, 2006). This thought process and awareness can be acquired by people, only via education (Alkis, 2007; 2010; Bakırcı & Yıldırım, 2017; Bonnet, 1999; Demirci, Sekin & Ünlü; 2002; Howell & Cartwright, 2009; Kaya, 2013; Lucerne Declaration, 2007, Tanrıverdi, 2009). In order to be successful at sustainable development, people should increase their knowledge and perception about this matter and gain new values regarding it during their period of education (Lucerne Declaration, 2007). In order to achieve this goal, the United Nations declared the 2005-2014 period as the "10 years of education for sustainable development". After that at the 2015 Summit of Sustainable Development, the United Nations determined the goals for sustainable development until 2030. These 17 determining sustainable development goals (SDG) (see for details Appendix A) and their 169 subtitles show global agendas purpose and scale. (UNDP, 2015). For 2030 sustainable development goals, studies are commissioned in Turkey. Turkey's current situation is evaluated at Expanded Expertise Committee Meeting as a "Search Conference" in 2017. At this meeting, experts reviewed the 17 SDGs and tried to determine the current situation in Turkey. During this meeting, SDGs separated into 6 subtitles (see for details Appendix B) and divided them as objective groups (URL 1, 2018). Parameters of

Received April 2021.

Cite as: Yüzbaşıoğlu, M. K. & Kurnaz, M. A. (2022). A review of Turkish science course curriculum in terms of sustainable development goals. *Acta Didactica Napocensia*, 15(1), 187-199, <https://doi.org/10.24193/adn.15.1.16>

progression towards reaching sustainable development goals are observed and evaluated by the National Strategy and Budget Department (URL 2, 2019). These evaluations can be guidance for relevant entities.

Considering the changes occurring today's world, the role of education in the process of building a sustainable future becomes stronger (Wolff, Sjöblom, Hofman-Bergholm & Palmberg, 2017). Today, sustainability issues are addressed at all levels of education from pre-school to higher education in many countries (UNESCO, 2014). It is seen that concepts such as sustainable future, sustainable lifestyle and sustainable development are included in the education curricula of countries (Wolff et al., 2017). However, it is claimed that sustainability is still covered at an insufficient level in the curriculum (Huckle & Wals, 2015). In the evaluation of sustainable development education, UNESCO has also reported that although the relevant education has increased in most of the countries, it is fully implemented in education systems and policies in a very small part (UNESCO, 2014).

Teachers play an important role in sustainable development education. Teachers might face some difficulties while teaching sustainable development to their students. The fact that sustainable development is an interdisciplinary subject unlike traditional subjects (Borg, Gericke, Hoglund & Bergman, 2012) and that active participation of students in lessons should be ensured (Mróz, Ocekiewicz & Tomaszewska, 2020) are among such difficulties. The issue of overcoming possible difficulties for teachers makes teacher training important as well. Many countries have just started to discuss the topic of sustainability in teacher education. It is considered that the difficulties and inadequacies in the related issues will not be reflected on the students thanks to the teachers who are well-trained on sustainable development issues (Dahl, 2019).

Another important issue in sustainability education is the curricula the implementers of which are teachers. It has been stated that most students do not receive any sustainable development education during their education (Maidou, Plakitsi & Polatoglou, 2019). It has been also highlighted that students' awareness of sustainable development issues is at a low level in the schools, where sustainable development issues are not included in the curriculum (Njoku, 2016). After the activities related to sustainable development education, it was observed that students feel themselves more competent in this regard (Evans, Tomas & Wood 2016; Olsson & Gericke, 2016). It is also stated that sustainable development education includes teaching processes that will improve students' ability to make choices by making inquiries (Vare & Scott, 2007). It is underlined that education for sustainable development is very important; therefore, this topic should be included in the curriculum explicitly (Maidou et al., 2019). Thus it can be expected a correlation between countries' curricula and SDGs.

In order to reach SDGs, it is important that students have awareness about sustainable development. Science education has an important place in students' understanding of sustainability (Murphy, Mallon, Smith, Kelly, Pitsia & Martinez Sainz, 2021). As in other countries in Turkey, one of the courses which can contribute to developing this awareness is Science Course. With an effective science course, it is possible to teach valid information about a sustainable World (Stratton, Hagevik, Feldman & Bloom, 2015). In the science course curriculum, it can be seen that there is a sustainable development concept (Ministry of National Education, 2018). At 8th grade level, students learn about sustainable life, conservative usage of resources and recycling under the subject of sustainable development, energy cycles and environmental sciences.

In literature, it can be seen the mentions about the importance of having a curriculum designed around the subject of sustainable development and its practice in order to achieve sustainable development goals (e.g. Aslan Efe, Yücel, & Efe, 2020; Aydın, 2021; Bozdemir Yüzbaşıoğlu, 2020; Di Fabio & Peiró, 2018; Teksöz, Şahin & Ertepinar, 2010; Yüksel, 2020). With the correct curriculum, it is aimed that individuals realize the relation between society and the environment. Thus developing an understanding of society, economy, and natural resources are related to sustainable development (Ministry of National Education, 2018). This can be achieved via effective science education. When literature is reviewed, it can be seen that the importance of curricula on developing an understanding of sustainability (Alkis, 2007; Demirci, 2006; Faiz & Bozdemir Yüzbaşıoğlu, 2019; Powers, 2004; Tanrıverdi, 2009). In Turkey, the science course curriculum has revised many times within the context of learning fields and learning outcomes (Yaz, Yüzbaşıoğlu & Kurnaz, 2019; Yaz & Kurnaz, 2020).

Although it is possible to see SDGs in curricula, it can be said that there is a lack of research about the updated curriculum. However, determining the level of sustainability education can guide the changes to be made regarding the curriculum (Şemin, 2020).

Aim of this research is to determine whether or not there is a consistent approach to science education regarding the correlation of SDGs. In order to achieve this information, the following questions will be asked during this study:

- 1- How many learning outcomes in science course literature are consistent with UN SDGs 2030?
- 2- What is the situation of learning outcomes which are consistent with UN SDGs 2030 distribution according to level grade and learning field?
- 3- Learning outcomes which are consistent with UN SDGs 2030, with which goals are they related?
- 4- What is the situation of learning outcomes' which are consistent with UN SDGs 2030 distribution according to field goals of "Search Conference"?

2. Method

In this study, Turkey's science course curriculums consistency with UN SDGs 2030 is researched. Document review method is used in this study. In document review, analysis of written information about targeted cases has been done (Creswell, 2007; Yıldırım & Şimşek, 2013). In this study, 2018 curriculums learning outcomes are used as a resource.

2. 1. Analysis of data

There are 302 learning outcomes in the curriculum. After these learning outcomes are determined, they are classified according to UNs SDGs 2030 which are shown in appendix A. During the analysis it is noticed that some learning outcomes are related to two or more goals, and the classification was made in consideration of this situation (see for sample analysis Table 1).

Table 1. Analysis sample of learning outcomes and SDG related goals.

Learning Outcome	Related SDG Number
1- Realization of negative health effects of alcohol consumption and smoking	G3
2- Discussion of battery wastes negative effects on environment and solution ideas	G12 – G15

When Table 1 is reviewed, it can be seen that learning outcome 1 is related to only one goal (G3), and learning outcomes 2 is related to two goals (G12-G15). It can be seen some goals can be related to more than one goal at these sample classification analysis. Learning outcome classification has made by two researchers individually, according to SDG criteria. (see Appendix A). Researchers then combined their classifications and reached a mutual point of view. Meanwhile, a third researcher who is experienced in the field of sustainable development has analyzed the relation between SDGs and learning outcomes. For this analysis of the third researcher; Miles and Hubermans (1994), the reliability formula was used. And 95% consistency between two analysis was determined. Above 70% is considered reliable for a study thus reliability of analysis has been confirmed.

3. Findings

Among 302 learning outcomes, there are 58 learning outcomes that are related to SDGs. Classifications were made within the context of these 58 learning outcomes. Learning outcomes distribution according to grade level and learning fields are shown in Table 2.

Table 2. Learning outcomes distribution according to grade level and learning fields.

			Grades						Total
			3	4	5	6	7	8	
Learning Fields	Vivace and Life	SDG	4	7	6	-	-	9	26
		A	7	1	3	22	15	16	64
		Total	11	8	9	22	15	25	90
	Earth and Universe	SDG	1	-	1	-	1	-	3
		A	4	5	6	5	9	3	32
		Total	5	5	7	5	10	3	35
	Physical Events	SDG	1	4	-	-	3	6	14
		A	15	16	14	19	23	10	97
		Total	16	20	14	19	26	16	111
	Matter and its Nature	SDG	-	1	-	6	5	3	15
		A	4	9	6	7	11	14	51
		Total	4	10	6	13	16	17	66

*SDG: Sustainable development goals, A: Other learning outcomes.

When Table 2 is reviewed, it can be seen that there are 26 learning outcomes that are related to SDGs in the field of Vivace and Life. The highest number of learning outcomes belong to the 8th-grade level (f=9). There are no learning outcomes present at the 6th and 7th-grade level. There are several learning outcomes present at 3rd grade (f=4) and 4th grade (f=7) level. In the field of Earth and Universe, there are 3 learning outcomes present and related to SDGs. These learning outcomes belong to 3rd grade (f=1), 5th grade (f=1) and 7th grade (f=1) level. There are no learning outcomes present at 4th, 6th and 8th-grade levels in this field. In the Physical Events field, there are 14 learning outcomes that are related to SDGs. These learning outcomes belong to 3rd grade (f=1), 4th grade (f=4), 7th grade (f=3) and 8th grade (f=6) level. There are no learning outcomes present at the 5th and 6th grade level in this field. In the Matter and Its Nature field, there are 15 learning outcomes that are related to SDGs. These learning outcomes belong to 4th grade (f=1), 6th grade (f=6), 7th grade (f=5) and 8th grade (f=3) level. There are no learning outcomes present at the 3rd and 5th grade level in this field.

Learning outcomes related to SDGs, their place and duration in Science Course Curriculum are shown in Table 3.

Table 3. Learning outcomes' which are related to SDGs, place and course duration in Science Course Curriculum.

Grade	Curriculums total learning outcome number	Number of SDG related learning outcomes		Total lecture hour	Lecture hours of SDG related learning outcomes	
		f	%		f	%
3rd Grade	36	6	16.67%	108	14	12.96%
4th Grade	43	12	27.91%	108	26	24.07%
5th Grade	36	7	19.44%	144	18	12.5%
6th Grade	59	6	10.17%	144	12	8.33%
7th Grade	67	9	13.43%	144	13	9.03%
8th Grade	61	18	29.51%	144	28	19.44%

When Table 3 is reviewed, it can be seen that the total number of learning outcomes and SDG related learning outcomes of different grades. SDG related learning outcomes mostly belong to the 8th-grade level (29.51%) and the lowest ratio belongs to the 6th-grade level (10.17%). Another information that can be gathered from Table 3 is the total lecture durations and SDG related courses' durations. The highest hours of education about SDGs belong to 4th grade (24.97%) and the lowest duration belongs to the 6th-grade level (8.33%).

In the curriculum, there are learning outcomes that can be related to more than one SDG and this situation has been explained in Table 1 via an example. Individual learning outcomes' relation to SDGs by number is shown in Table 4.

Table 4. Learning outcomes relations to SDGs classified by grade level.

Grade	Number of SDG related learning outcomes	Learning outcomes SDG relation count					
		1 SDG	2 SDG	3 SDG	4 SDG	5 SDG	6 SDG
3rd Grade	6	1	1	2	2	-	-
4th Grade	12	6	2	3	-	1	-
5th Grade	7	1	-	-	2	3	1
6th Grade	6	2	3	1	-	-	-
7th Grade	9	3	2	3	1	-	-
8th Grade	18	4	8	6	-	-	-
Total	58	17	16	15	5	4	1

When Table 4 is reviewed it can be seen that the learning outcomes' relations to how many SDGs which they correlate. The analysis determined the relation numbers are: 1 SDG (f=17), 2 SDG (f=16), 3 SDG (f=15), 4 SDG (f=15), 5 SDG (f=4) and 6 SDG (f=1). 58 SDG related learning outcomes have a total number of 140 correlations. Learning outcomes' relations with goals, which are classified by grade level is shown in Table 5.

Table 5. SDG related learning outcomes distribution according to grade level and goals.

Goal (G)	3 rd Grade	4 th Grade	5 th Grade	6 th Grade	7 th Grade	8 th Grade	Total
G 1	-	-	-	-	1	1	2
G 2	1	4	5	-	-	2	12
G 3	-	6	-	2	-	1	9
G 4	-	-	-	-	-	-	-
G 5	-	-	-	-	-	-	-
G 6	2	-	1	-	-	-	3
G 7	-	2	-	4	3	5	14
G 8	-	2	-	-	-	5	7
G 9	-	-	-	1	2	6	9
G 10	-	-	-	-	-	-	-
G 11	-	-	-	-	-	-	-
G 12	4	5	7	2	8	8	34
G 13	1	1	5	2	2	6	17
G 14	4	2	6	-	2	2	16
G 15	5	2	6	-	2	2	17
G 16	-	-	-	-	-	-	-
G 17	-	-	-	-	-	-	-
Goal related learning outcomes	17	24	30	11	20	38	140

It can be seen that the SDG related learning outcomes' distribution according to 17 goals. SDG related learning outcomes are mostly related to goal 12 (f=34), meanwhile, the lowest number belongs to goal 1 (f=2). There are no learning outcomes present at the curriculum in relation to G4, G5, G10, G11, G16, and G17. SDG related learning outcomes mostly belong to the 8th-grade level (f=38), and the lowest number belongs to the 6th-grade level (f=11). SDG related learning outcomes' distribution according to "Search Conference" goals is shown in Table 6.

Table 6. *SDG related learning outcomes' distribution according to "Search Conference" goals.*

Goal groups*	3 rd Grade	4 th Grade	5 th Grade	6 th Grade	7 th Grade	8 th Grade	Total
Group 1	1	4	5	-	1	3	14
Group 2	-	6	-	2	-	1	9
Group 3	2	2	1	4	3	5	17
Group 4	-	2	-	1	2	11	16
Group 5	14	10	24	4	14	18	84
Group 6	-	-	-	-	-	-	-
Goal related learning outcomes	17	24	30	11	20	38	140

* See for details Appendix B

When Table 6 is reviewed, it can be seen that the highest number of SDG related learning outcomes belong to goal group 5 (f=84). The lowest number of SDG related learning outcomes belong to goal group 2 (f=9). There are no learning outcomes present in group 6 in the curriculum. For group 1 there are no learning outcomes at the 6th-grade level. For group 2 there are no learning outcomes at 3rd, 5th and 7th-grade levels. For group 4 there are no learning outcomes at 3rd and 5th-grade level.

4. Discussion

Within the context of a discussion on the learning outcomes of the Science Course Curriculum has been analyzed. From 302 learning outcomes, 58 of them are related to SDGs. These learning outcomes belong to different grade levels between the 3rd and 8th. In order to achieve sustainable development, it is important to educate people via a science course that correlates with sustainable development education (Eilks, Nielsen & Hofstein, 2014; Feldman & Nation, 2015; Stratton et al., 2015; Tippins, Pate, Britton & Ammons, 2015). In order to remind students about sustainability, it is important to have SDG related learning outcomes at every grade level. It is believed that sustainable development education prepares individuals to cope with the difficulties they may face in the future (Vare & Scott, 2007). It is also thought that students' finding opportunities to encounter the concept of sustainability at all grade levels will contribute to a sustainable future. When the distribution of learning outcomes according to grade levels and education duration is analyzed, there is no specific distribution has spotted. This situation shows that SDGs and learning outcomes about sustainable development were not constructed systematically in the curriculum. In order to achieve sustainable development, curricula, activities and support programs are critical (Ristic, Vujinic & Radevic, 2019). Thus it is important to distribute learning outcomes between correct grade levels in order to achieve global and national sustainable development. With correct distribution, students will be taught about sustainable development every year thus it will be easier to learn learning outcomes.

Also 58 learning outcomes' distribution according to learning fields has been reviewed. The highest number of learning outcomes belong to Vivace and Life field. In order to use resources efficiently, people should have information about the environment (Anyolo, Kärkkäinen & Keinonen, 2018). In the Vivace and Life learning field, there are learning outcomes about the environment, energy cycles and health, thus it can be assumed that it is consistent that this learning field has the most SDG related learning outcomes (Yaz, Yüzbaşıoğlu & Kurnaz 2019). Earth and Universe learning field has only 3 SDG related learning outcomes. Even though this learning field is present at every grade level, it is noticeable that it only has 3 SDG related learning outcomes. When the learning outcomes' relations with learning fields are analyzed, it can be seen that there are no learning outcomes present within Vivace and Life field at 6th and 7th grade, Earth and Universe field at 4th, 6th and 8th grade, Physical Events field at 5th and 6th grade, Matter and Its Nature at 3rd and 5th-grade level. This lack of learning outcomes at these levels can be seen as a defect of the curriculum. Sustainable development is seen as the main component of primary education (Wolff et al., 2017). Unlike traditional subjects, it has an interdisciplinary structure (Borg et al., 2012). The deficiencies identified in the relevant learning fields and grade levels should be reinforced in different lesson. The analysis showed that the highest number of SDG related learning outcomes belong to G12 (Responsible consumption and

production), the lowest number of SDG related learning outcomes belong to G1 (No poverty). Thus it can be said that the topics of management and usage of natural resources based on conscious production and consumption, management of chemicals, green production, eco-efficiency practices, and research and development efforts contribute highly to the curriculum. The topic which has the least amount of education time is about ending hunger. Also, there are no learning outcomes related to G4 (Quality Education), G5 (Gender Equality), G10 (Reduced Inequalities), G11 (Sustainable cities and communities), G16 (Peace, justice and strong institutions) and G17 (Partnerships for the goals) in the curriculum. These goals are about the quality of education, gender equality, replacement of inequalities, sustainable cities and societies, peace, justice, strong partnerships and partnerships with common goals, thus they didn't hold a place in the curriculum. In other words, in the curriculum, these subjects didn't get covered under the topic of sustainability. Although the science course has an important place in structuring sustainability issues by the students (Murphy et al., 2021), the concept of sustainability is also related to other courses. While the learning outcomes related to the relevant goals are not included in the science course, the cooperation of teachers in different curricula and subjects is important in eliminating this deficiency (Borg et al., 2012).

SDG related learning outcomes mostly seen at the 8th-grade level, meanwhile, the lowest number of SDG related learning outcomes belong to 6th grade. This situation can be expected as normal when the students' age group at the 8th-grade level is considered. Studies showed that 2nd and 3rd-grade students have an understanding of environmental problems and these problems' negative effects on themselves (Maidou et al., 2019; Duzenli, Alpak & Yilmaz, 2019). Because curriculums have an important role in achieving sustainable development, more learning outcomes in the lower grades can contribute to this process (Ristic, Vujinic & Radevic, 2019).

The distribution of the related learning outcomes was examined according to the target groups of the "Search Conference". Within the "Search Conference"s study groups, group 5 has the highest number of SDG related learning outcomes. Topics within the context of group 5, which are: Conscious Production and Consumption, Fight with Climate Change, Life at Sea, Life at Land and they are also related to curriculum. This shows that the "Search Conference"s studies are mostly correlated with environmental subjects of science courses. In order to train individuals who, have an understanding and consciousness about the environment, environmental education should not only be seen as a course but also it should reach every part of society (Bozdemir & Faiz, 2018; Özbuğutu, Karahan & Tan, 2014). Thus, the chance to thrive the development of individuals about the environment and their experience about the environment is provided (Duzenli, Alpak & Yilmaz, 2019). While environmental problems are seen as the subject of sustainable development education in the studies carried out, it has been found out that social and economic issues are not seen as elements of sustainable development education (Maidou et al., 2019). It can be expected as normal to not having an education about peace and justice when science courses subjects considered but not having education about a partnership with common goals can lead to a lack of knowledge about international organizations' efforts which concerns environmental sustainability. Teksoz (2013) stated that international sharing and participation is important in order to achieve sustainable development, and added the benefits of cooperation of more than one institute. Goal groups within the context of "Search Conference", are specifically designed for Turkey (URL-1, 2018) and this increases the importance of the data given in Table 6. Within the goal groups, there are no SDG related learning outcomes for group 1 in 6th grade, for group 2 at 3rd, 5th and 7th grade, for group 4 3rd and 5th grade and there are no SDG related learning outcomes for group 6 at any grade level. Thus in order associations required for education should get attention in studies like "Search Conference". For sustainable development, individuals should have access to information and education, and efforts should be made in order to supply this (Ristic, Vujinic & Radevic, 2019). For this reason, in order to achieve sustainability goals, SDG related learning outcomes should be in the curriculum without any minus.

There are 58 SDG related learning outcomes, but their total related goal number is 140 due to one learning outcome that can have more than one correlation. Learning outcomes are related to 1 to 6 SDGs. 48 learning outcomes are correlated with 1,2 or 3 SDG. This shows that learning outcomes are usually affiliated with a low number of SDGs. Remaining 10 learning outcomes are correlated with 4,5 or 6 SDGs. It can be said that with these learning outcomes students get more information about

sustainability. Learning outcomes belong to the highest grade levels are related to a lower number of SDGs. This shows that in higher grade levels there is enough direction and even though deficiencies there is a base structure for sustainability education.

5. Conclusions and Recommendations

Curricula have an important role in developing a positive attitude towards the environment in individuals (Abolaji, Oke & Adebajo, 2011). Data from this study shows that the curriculum has deficiencies in containing sufficient SDGs. Priorities for sustainable development education should be determined and efforts should be made to achieve those (Şemin, 2020; Teksöz, 2013). Thus, SDG related learning outcomes in the curriculum should be consistent with environmental goals. When SDG related learning outcomes are reviewed, it can be seen that learning outcomes related to the environment are more than others. It is important to contribute to good deeds about the environment in order to make the habitat more livable for future generations (Duzenli, Alpak & Yilmaz, 2019). Also, studies showed that it is necessary to teach environmental problems (Ezberci Cevik & Kurnaz, 2020). Thus having a high number of environment-related learning outcomes is a positive aspect of the curriculum.

Learning outcomes related to the low number of goals suggest that students are directed to specific goals. 20% of learning outcomes are related to SDGs and this shows a deficiency of curriculum about sustainability. When we reviewed former curricula this deficiency can also be seen (Tanrıverdi, 2009). Efforts should be made in order to make the world more livable for future generations and a young population has an important responsibility on this subject. Educators should train individuals for the future. In order to achieve sustainable developments, curricula should be more qualified and they should be kept up to date. Learning outcomes should have more correlations with SDGs. SDG related learning outcomes should be appropriate for student levels and should be distributed accordingly. There should be more SDG related learning outcomes in the field of Earth and Universe.

SDG related learning outcomes should be added to the learning fields which have no SDG related learning outcomes. There should be more SDG related learning outcomes at the 6th-grade level. There should be more SDG related learning outcomes for G17. In order to achieve sustainable development, these learning outcomes should be revised to fill the deficiencies of the curriculum.

Learning outcomes at higher grade levels should have more relations to SDGs. When reviewing curricula, it should be considered that the SDGs that are not in the science course, can be within social studies and life sciences.

References

- Abolaji, M. A., Oke, O. A., & Adebajo, A. (2011). An investigation of environmental education knowledge for sustainable development in high school sectors in UK. *Journal of Life Sciences*, 5(8), 670-675.
- Alkis, S. (2007). The rising paradigm in teaching geography: A sustainable World. *International Journal of Geography and Geography Education*, 15, 55-64.
- Alkis, S. (2010). Geography education for sustainability. R. Ozey and S. Incekara (Eds). *In Concept and Changes in Geography Education*. (pp. 45-72), Ankara: Pegem Akademi. (in Turkish).
- Anyola, E., Kärkkäinen, S., & Keinonen, T., (2018). Implementing education for sustainable development in Namibia: school teachers' perceptions and teaching practices. *Journal of Teacher Education for Sustainability*, 20, 1, pp. 64-8. <http://dx.doi.org/10.2478/jtes-2018-0004>
- Aslan Efe, H. Yücel, S., & Efe, R. (2020). The effect of making documentaries on science student teachers' attitudes towards the environment for sustainable development. *YYU Journal of Education Faculty*, 17(1), 436-454. <https://doi.org/10.33711/yyuefd.692958>

- Aydın, E., (2021). *Determining the sustainable environment attitude of secondary school students and science teachers and the learning level of students with regard to environmental issues*. Unpublished Doctor's Degree Thesis. Gazi University, Ankara.
- Bakırcı, H., & Yıldırım, I. (2017). The influence of common knowledge construction model on students' conceptual understanding and permanence of knowledge in terms of greenhouse effect, *Journal of Kirsehir Faculty of Education [Kırşehir Eğitim Fakültesi Dergisi]*, 18(Special Issue), 45-63.
- Baykal, H., & Baykal, T. (2008). Environmental problems in a globalized world. *Mustafa Kemal University Journal of Social Sciences Institute*, 5(9), 1-17.
- Bonnett, M. (1999). Education for sustainable development: a coherent philosophy for environmental education? *Cambridge Journal of Education*, 29(3), 313-324. <https://doi.org/10.1080/0305764990290302>
- Borg, C., N. Gericke, H. O. Hoglund, & E. Bergman. 2012. The barriers encountered by teachers implementing education for sustainable development: Discipline bound differences and teaching traditions. *Research in Science & Technological Education*, 30 (2), 185–207. <https://doi.org/10.1080/02635143.2012.699891>
- Bozdemir, H., & Faiz, M. (2018). Ecocentric, anthropocentric and antipathetic attitudes of teacher candidates towards the environment. *Sakarya University Journal of Education*, 8(1), 61-75. <https://doi.org/10.19126/suje.330546>
- Bozdemir Yüzbaşıoğlu, H. (2020). Environmental issues and critical perspectives mentioned at public service announcements which are prepared by primary school pre-service teachers. *International Journal of Psychology and Educational Studies*, 7(4), 143-159.
- Bruntland, G. (1987). *Our common future: the world commission on environment and development*. Oxford, Oxford University Press.
- Collin, P.H. (2004). *Dictionary of Environment & Ecology*. EISBN-13: 978-1-4081-0222-0, 265 s, Bloomsbury Publishing plc, London.
- Creswell, J. W. (2007). *Qualitative Inquiry & Research Design – Choosing Among Five Approaches*, 2nd ed., SAGE Publications: Thousand Oaks, California.
- Dahl, T. (2019). Prepared to teach for sustainable development? Student Teachers' beliefs in their ability to teach for sustainable development. *Sustainability*, 11(7), 1993. <https://doi.org/10.3390/su11071993>
- Demirci, A., Sekin, S., & Ünlü, M. (2002). The Importance of geography in terms of occupation and its usage in Turkey. *International Journal of Geography and Geography Education*, 5, 171-185.
- Demirci, A. (2006). Developing international geography standards for a more sustainable future and its underlying reasons. *Proceedings of the Second International Conference of the Asian Philosophical Association, DaeDong Philosophical Association*, 413-426, Korea.
- Di Fabio, A., & Peiró, J. M. (2018). Human capital sustainability leadership to promote sustainable development and healthy organizations: a new scale. *Sustainability*, 10(7), 2413. <https://doi.org/10.3390/su10072413>
- Duzenli, T., Alpak, E. M., & Yilmaz, S. (2019). Children's imaginations about environment and their perceptions on environmental problems. *Fresenius Environmental Bulletin*, 28 (12A), 9798-9808.
- Eilks, I., Nielsen, J. A., & Hofstein, A. (2014). Learning about the role of science in public debate as an essential component of scientific literacy. In C. Bruguière, A. Tiberghien, P. Clément (Eds.), *Topics and trends in current science education*, 85-100.

- Evans, N., Tomas L., & Woods, C. (2016). Impact of sustainability pedagogies on preservice teachers' self-efficacy. *Journal of Education for Sustainable Development*, 10(2), 243-261. <https://doi.org/10.1177/0973408216650953>
- Ezberci Cevik, E., & Kurnaz, M. A. (2020). Investigation of prospective science teachers' opinions and sensitivity towards environmental. *Fresenius Environmental Bulletin*, 29 (4A), 2662-2669.
- Faiz, M., & Bozdemir Yüzbaşıoğlu, H. (2019). Teacher candidates' awareness of sustainable development. *Abant İzzet Baysal University Journal of Faculty of Education*, 19 (4), 1255-1271. <https://doi.org/10.17240/aibuefd.2019..-662082>
- Feldman, A., & Nation, M. (2015). Theorizing sustainability: An introduction to science teacher education for sustainability. In S.K. Stratton, R. Hagevik, A. Feldman, M. Bloom (Eds.). *Educating science teachers for sustainability*, (pp.3-13), USA: Springer.
- Howell, R., & Cartwright, W. (2009). The Ethics of a sustainable economy: Implications for public policy. *Ethical Foundations of Public Policy Conference* (ss. 1-13). Wellington, New Zealand: Victoria University.
- Huckle, J., & Wals, A. E. (2015). The UN decade of education for sustainable development: business as usual in the end. *Environmental Education Research*, 21(3), 491-505. <https://doi.org/10.1080/13504622.2015.1011084>
- Kaya, M. F. (2013). A scale development study on the attitudes of sustainable development, *International Journal of Geography and Geography Education*, 28, 175-193.
- Lucerne Declaration. (2007). Lucerne declaration on geographical education for sustainable development (Editors: Haubrich, H. & Reinfried, S. & Schleicher, Y.). *Geographical Views on Education for Sustainable Development. Proceedings of the Lucerne-Symposium*, Switzerland, July 29-31, 2007. Geographiedidaktische Forschungen, Volume 42, p. 243-250, 2007.
- Maidou, A., Plakitsi, K., & Polatoglou, H. M. (2019). Knowledge, perceptions and attitudes on education for sustainable development of pre-service early childhood teachers in Greece. *World Journal of Education*, 9(5), 1-15. <https://doi.org/10.5430/wje.v9n5p1>
- McIntyre, G. (1993). *Sustainable tourism development: guide for local planners*. World Tourism Organization (WTO).
- Ministry of National Education. (2018). *Science Course Curriculum*. Ankara: Board of Education.
- Miles, M. B., & Huberman, M. A. (1994). *An expanded sourcebook qualitative data analysis*. London: Sage.
- Mróz, A., Ocetkiewicz, I., & Tomaszewska, B. (2020). What should be included in education programmes—The socio-education analysis for sustainable management of natural resources. *Journal of Cleaner Production*, 250, 119556. <https://doi.org/10.1016/j.jclepro.2019.119556>
- Murphy, C., Mallon, B., Smith, G., Kelly, O., Pitsia, V., & Martinez Sainz, G. (2021). The influence of a teachers' professional development programme on primary school pupils' understanding of and attitudes towards sustainability. *Environmental Education Research*, 1-25. <https://doi.org/10.1080/13504622.2021.1889470>
- Njoku, C. (2016). Awareness of climate change and sustainable development issues among junior secondary school (jss) students in Port Harcourt Metropolis, Nigeria. *International Journal of Curriculum and Instruction*, 8(2), 29-40.
- Olsson, D., & Gericke, N., (2016). The adolescent dip in students' sustainability consciousness: Implications for education for sustainable development. *The Journal of Environmental Education*, 47(1), 35-51. <https://doi.org/10.1080/00958964.2015.1075464>
- Özbuğutu, E., Karahan, S., & Tan, C. (2014). Environmental education and its alternative methods—a literature review. *Mustafa Kemal University Journal of Social Sciences Institute*, 11(25), 393-408.
- Ozey, R. (2009). *Environmental Issues*, Istanbul: Aktif Publishing. Extended 3. Printing. (in Turkish).

- Powers, A. L. (2004). Teacher preparation for environmental education: Faculty perspectives on the infusion of environmental education into preservice methods courses. *The Journal of Environmental Education*, 35, 3-11.
- Ristic, L., Vujicic, M., & Radevic, B. (2019). Poverty reduction as a factor of sustainable development of rural areas in the republic of Serbia. *Fresenius Environmental Bulletin*, 28 (9), 6998-7005.
- Şemin, F. K., (2020). Developing sustainable education disposition scale and teacher views regarding the education disposition. *Journal of Education and Future*, (17), 65-81. <https://doi.org/10.30786/jef.483133>
- Stratton, S. K., Hagevik, R., Feldman, A., & Bloom, M. (2015). *Toward a Sustainable Future: The Practice of Science Teacher Education for Sustainability*. In S.K. Stratton, R. Hagevik, A. Feldman and M. Bloom (Eds.). *Educating Science Teachers for Sustainability* (pp 445-457). USA: Springer.
- Tanrıverdi, B. (2009). Analyzing primary school curriculum in terms of sustainable environmental education. *Education and Science*, 34(151), 89-103.
- Teksöz, G., Şahin, E., & Ertepinar, H. (2010). Environmental literacy, pre-service teachers, and a sustainable future. *Hacettepe University Journal of Education*, 39, 307- 320.
- Teksöz, G. (2013). Learning from the past: Education for sustainability. *Bogazici University Journal of Education*, 31(2), 73-97. (in Turkish).
- Tietenberg, T. (2006). *Environmental and natural resource economics*. New York: HarperCollins Publishers.
- Tippins, D., Pate, P. E., Britton, S., & Ammons, J. (2015). A fork in the road: reclaiming a conversation on sustainability for science teacher education in the Anthropocene. *In Educating Science Teachers for Sustainability* (pp. 69-87). Springer, Cham.
- URL 1, (2018). UNESCO National Commission of Turkey 2016 – 2017 Annual Reports, retrieved from http://www.unesco.org.tr/Content_Files/Content/Yayinlar/Faliyet%20Raporu%202016-2017-.pdf
- URL 2, (2019). Turkish Republic Presidency of Strategy and Budget (2019). Sustainable development goals assessment report. retrieved from <http://www.surdurulebilir-kalkinma.gov.tr/wp-content/uploads/2020/03/Surdurulebilir-Kalkinma-Amaclari-Degerlendirme>
- UNESCO, (2014). *Shaping the Future We Want. UN Decade of Education for Sustainable Development (2005–2014); Final Report*; UNESCO: Paris, France.
- United Nations Development Programme (2015). Sustainable Development Goals, retrieved from <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>
- Vare, P., & Scott, W. (2007). Learning for a change: Exploring the relationship between education and sustainable development. *Journal of Education for Sustainable Development*, 1(2), 191-198. <https://doi.org/10.1177/097340820700100209>
- WCED. (1987). *World Commission on Environment and Development, Our Common Future*. Oxford: OUP.
- Wolff, L. A., Sjöblom, P., Hofman-Bergholm, M., & Palmberg, I. (2017). High performance education fails in sustainability?—A reflection on Finnish primary teacher education. *Education sciences*, 7(1), 32. <https://doi.org/10.3390/educsci7010032>
- Yaz, Ö. V, Yüzbaşıoğlu, M. K., & Kurnaz, M. A. (2019). Comparative Examination of the Changes of Subject / Learning Areas of the Curriculum of Science Course, *International Conference on Science, Mathematics, Entrepreneurship and Technology Education*, April 12 – 14, 2019, IZMIR.
- Yaz, Ö.V., & Kurnaz, M.A. (2020). *Comparative analysis of the science teaching curricula in Turkey*, *SAGE Open*, 10(1). <https://doi.org/10.1177/2158244019899432>

Yıldırım, A., & Şimşek, H. (2013). *Qualitative research methods in social sciences*. (9th edition). Ankara: Seckin Publishing.

Yüksel, İ. (2020). Opinions of teacher candidates in science education on the efficient use of resources. *International Journal of Society Researches*, 15(22), 1015-1030. <https://doi.org/10.26466/opus.648555>

Authors

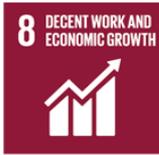
Mustafa Kemal YÜZBAŞIOĞLU, Ministry of National Education, Kastamonu (Turkey).

E-mail: m.kemalyuzbasioglu@gmail.com

Mehmet Altan KURNAZ, Kastamonu University, Department of Mathematics and Science Education, Faculty of Education, Kastamonu (Turkey). E-mail: altan.kurnaz@gmail.com

Appendix

A- UN 2030 Sustainable Development Goals (UNDP, 2015)

					
					
					
Goal	Explanation				
G1	End poverty in all its forms everywhere.				
G2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture.				
G3	Ensure healthy lives and promote well-being for all at all ages.				
G4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.				
G5	Achieve gender equality and empower all women and girls.				
G6	Ensure availability and sustainable management of water and sanitation for all.				
G7	Ensure access to affordable, reliable, sustainable and modern energy for all.				
G8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.				
G9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.				
G10	Reduce inequality within and among countries.				
G11	Make cities and human settlements inclusive, safe, resilient and sustainable.				
G12	Ensure sustainable consumption and production patterns.				
G13	Take urgent action to combat climate change and its impacts.				
G14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development.				
G15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.				
G16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.				
G17	Strengthen the means of implementation and revitalize the global partnership for sustainable development.				

B- Study Subjects in Search Conference for Turkey's National on Sustainable Development Agenda (URL 1, 2018)

Study Subjects		Related Goals of UN
Group 1	End Poverty, Eliminate Hunger	G1, G2
Group 2	Health and Welfare, Quality Education, Gender Equality	G3, G4, G5
Group 3	Access to Healthy Water, Accessible Clean Energy	G6, G7
Group 4	Employment and Economic Growth, Industry, Innovation and Infrastructure, Reducing Inequalities	G8, G9, G10
Group 5	Sustainable Cities and Communities, Conscious Production and Consumption, Combating Climate Change, Life in Water, Life on Land	G1, G12, G13, G14, G15
Group 6	Peace and Justice, Partnerships for Goals	G16, G17