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Development and Implementation of a Sustainable Development Goals (SDGs) Unit: Exploration of Middle School Students' SDG Knowledge

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Abstract: Perhaps the largest lesson in our time is to teach students how to sustain our world's resources while improving well-being for people all over the world. Integrating the Sustainable Development Goals (SDGs) with the curriculum for K-12 education would help middle students understand why the world's resources are important, how the world should be treated and protected, and how they play a vital role in its future. However, there is a lack of curriculum material to put into practice regarding SDGs at K-12 levels. This study set out to address this need through design-based research, leading to the development and evaluation of the application of a learn–think–act approach-based Sustainable Development Goals (SDGs) unit. This unit was implemented over 8 weeks to help enhance middle school students' SDG knowledge. Participants were a group of 20 7th grade students attending an environmental education and climate change elective course at a public school in Turkey. Data on SDG knowledge were collected from students through semi-structured interviews before and after the application of the unit. Transcriptions of the interviews were analyzed with deductive content analysis based on the rubric. The results revealed that a learn–think–act approach-based Sustainable Development Goals unit enhanced middle school students' SDG knowledge.

Keywords: sustainable development goals (SDGs); SDG knowledge; education for sustainable development goals; middle school students

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1. Introduction

Our world is currently suffering the combined effects of complex environmental, economic and social challenges like poverty, hunger, poor health and low levels of well-being, climate change, illiteracy, access to clean energy and water, homelessness, and increasing income gaps and inequalities, etc. The scale and severity of these challenges impacts every aspect of our lives in a globalized context [1–5]. In an effort to address these challenges and transform our world, the United Nations adopted the 2030 Agenda for Sustainable Development comprising 17 Sustainable Development Goals (SDGs) in 2015 (see Figure 1). Together, the SDGs enable us to appreciate the scope of the challenges we have been facing and the range of actions we should be taking [6]. The aim of the SDGs is to end local and global challenges that all life has been facing and ensure a global road map for people, planet, prosperity, peace and partnership all over the world now and in the future by 2030 [6,7]. That is, the SDGs were devised for us to take action together on environmental, economic and social challenges like poverty, hunger, epidemics, education, inequalities, energy, climate change, peace and many others.



Figure 1. Sustainable Development Goals [7].

Achieving the SDGs is crucial, but it is no easy task and requires a deep transformation in our way of our thinking and acting [6]. Undoubtedly, education can be a powerful and transformative tool to take action for achieving the SDGs, and schools have an important role in facilitating this [8,9]. It follows that integrating the SDGs into K-12 education can help to ensure that all individuals gain the theoretical and practical knowledge necessary for us to achieve the SDGs by the year 2030 [10]. Teaching the SDGs to students at early ages is thought crucial to achieve the SDGs, because students can learn about the world from a young age, gain an understanding of global challenges, and be global citizens by taking responsibility for their actions in the world they live in. Integrating the SDGs into K-12 levels can develop students' knowledge, awareness, skills, competence, values, and world views so that they can act to build a more sustainable world [11]. In this way, teaching the SDGs prepares students and communities to engage in transformative change for sustainable development throughout their lives. In addition, teaching the SDGs encourages students to discover local and global issues and their connections with their own lives [12]. Therefore, students can grasp that their lifestyle choices impact the world profoundly and that every one of us can do something to take care of our planet. Students can learn to make sustainable ways of living a habit and find ways for everyone to live better. Students can cope with rapid changes, growing complexity, disputable knowledge claims and inescapable uncertainty if they learn the SDGs [13,14]. Effective SDG education is vital to promote students' motivation to participate in SDG-minded activities [15].

In the relevant literature, most of the studies relate to the implementation of the SDGs in higher education and university students' knowledge, perception, and awareness about the SDGs [10,16–28], while a very limited body of research has focused on implementation of the SDGs in K-12 education [29–34]. One of the reasons for so few implementations of the SDGs in K-12 levels is the lack of curriculum materials (learning tools) to put into practice the SDGs for K-12 levels [35–37]. There is a perceived need to develop curriculum materials that may help systematically introduce the SDGs in classes [38]. Therefore, the aim of this research is to develop and implement a learn–think–act approach-based Sustainable Development Goals unit that will help enhance middle school students' knowledge about the SDGs. In this manner, the research question is:

- How can the Sustainable Development Goals (SDGs) unit be developed and implemented to improve middle school students' SDG knowledge?

2. Research Background

2.1. Integrating Sustainable Development Goals (SDGs) into K-12 Education

The Sustainable Development Goals are complex to teach and require a holistic and transformational education that equips students with knowledge and competence in finding

ways and possible solutions to describe and link the environmental, economic and social aspects of global problems [6,39]. Integrating the Sustainable Development Goals (SDGs) into K-12 education is an important step for this aim, since it supports learners to take wise decisions and actions for economic viability, environmental integrity and a just society for present and future generations [6]. Integrating the SDGs in classes at school is vital if we are to raise our children to have necessary knowledge about the SDGs and the competence for being global citizens [40]. With the integration of the SDGs into K-12 education, individuals can be trained to consider the current and future environmental, social, economic and cultural impacts of their own actions from a local and a global perspective [6,41–43].

Bringing SDGs to K-12 classrooms can help students gain cognitive, socio-emotional and behavioral learning outcomes so that they can cope with the challenges of each SDG, and in this way, achievement of the SDGs gets easier. Rieckmann [6] described learning objectives for each SDG in the cognitive, socio-emotional and behavioral domains. According to this, the cognitive domain includes required knowledge and thinking skills to grasp the SDGs better and the challenges to achieve them. The socio-emotional domain involves social skills like self-reflection, attitudes, values and motivations so that learners can collaborate, negotiate and communicate about the SDGs. The behavioral domain comprises competencies for action. For instance, learning objectives for SDG 1 (No poverty) described by Rieckmann [6] are: (1) cognitive domain—"the learner explains the causes and impacts of poverty," (2) socio-emotional domain—the learner shows sensitivity and empathy regarding the issues of poverty, and (3) behavioral domain—"the learner proposes solutions related to poverty." In this research, the learning objectives for each SDG were specified in accordance with objective domains for the SDGs determined by Rieckmann [6].

2.2. Learn–Think–Act Framework

The learn–think–act approach is a pedagogical approach helping students learn about global issues, think critically and find ways to use their knowledge themselves in meaningful and suitable ways [44]. Learn–think–act is an approach compatible with the SDGs and global citizenship in education [45]. This approach is one of the most appropriate ways of teaching the SDGs, since it includes apparent realization of the linkage between understanding, reflection and action, as in the SDGs [35]. Learn–think–act is based on three main parts (see Figure 2). In the "learn" part, learners can deepen their knowledge and understand the progress of skills for thinking and acting on the SDGs. In the "think" part, learners can determine additional learning needs and manage autonomous action they choose with critical and creative thinking. In the "act" part, learners can achieve further learning and thinking thanks to action and reflection. The learn–think–act approach includes a rigorous development of knowledge, comprehension of global issues, chances to develop new skills, critical thinking, and acting and reflecting effectively [45]. Figure 2 shows how a learn–think–act framework works. According to this framework, learning and thinking about the SDGs can inspire actions, while taking action enhances learners' motivation to improve their knowledge of issues and critical thinking about issues and their action choices. Martin et al. [46] stated that use of the learn–think–act approach to teach global issues helps students think deeply about their actions and discover other ways to become active and responsible global citizens. Therefore, in this research, this framework was applied throughout the development and implementation of the Sustainable Development Goals unit.

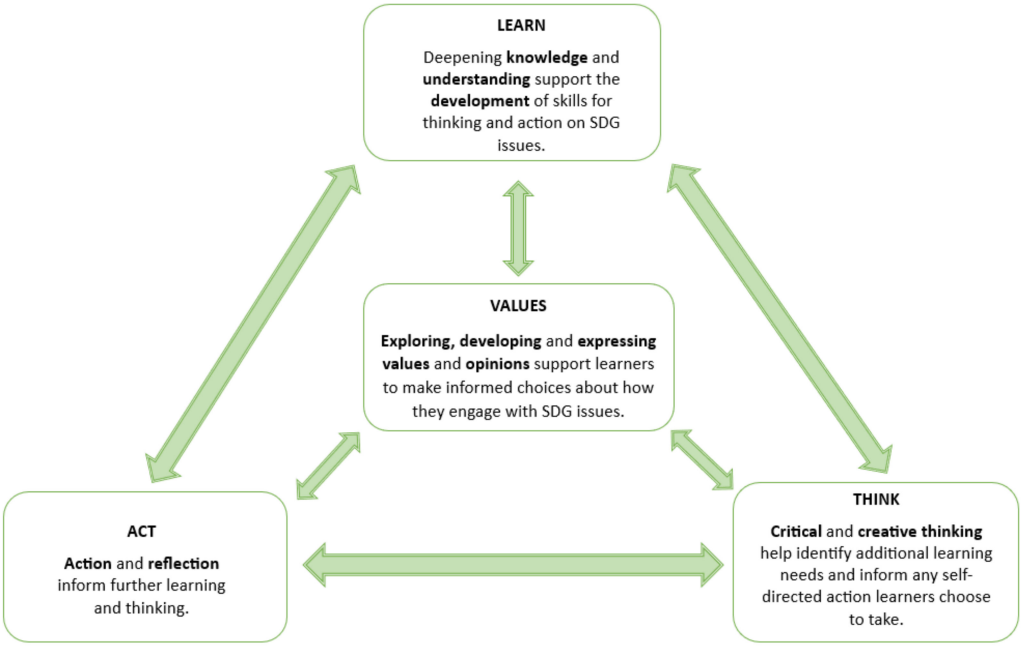


Figure 2. The learn–think–act framework [45].

3. Materials and Methods

3.1. Research Design

The main purpose of this research was to design and implement a learn–think–act approach-based Sustainable Development Goals unit that will help enhance middle school students' knowledge about the SDGs. In order to achieve this aim, design-based research (DBR) was employed in the current study. DBR is a systematic and flexible methodology aiming to improve existing materials such as curriculum sequences, technological tools, activity structures, and cognitive assessments through design, development, implementation, and iterative analysis in real-world settings [47–50]. In other words, DBR mixes empirical educational research with the theory-driven design of learning environments and help us understand how, when, and why educational innovations work in practice [51]. DBR comprises three parts: (a) a designer (i.e., researcher in this study), (b) a practitioner (i.e., science teacher in this study), and (c) an artefact (i.e., Sustainable Development Goals unit in this research) [52]. In this study, the research phases suggested by McKenney and Reeves [53] were followed within the scope of design-based empirical research. In accordance with these phases, a learn–think–act approach-based Sustainable Development unit was developed, and this unit was taught to 20 7th grade students by their science teacher. In addition, the development of students' SDG knowledge was also assessed in the scope of the research.

3.2. Sustainable Development Goals Unit Development

The Sustainable Development Goals unit was developed according to the learn–think–act framework devised by Oxfam [45]. The backward design (also known as understanding by design) approach developed by curriculum experts Wiggins and McTighe [54] was used in the SDG unit development process (see Figure 3). Accordingly, the unit was developed in 3 main stages:

(1) Identifying desired results

In the first stage of the backward design, the learning objectives of the course, along with the knowledge and skills students learn, are established [54]. Therefore, the learning objectives for each SDG were specified in accordance with the objective domains for the SDGs determined by Rieckmann [6] (cognitive, socio-emotional and behavioral domains) and the learn–think–act approach.

(2) Determining acceptable evidence

In the second stage, a combination of suitable performance tasks and assessments are undertaken to enable learners to demonstrate their understanding and learning [54]. The assessments and performance tasks were determined to assess students' knowledge about the SDGs.

(3) Planning learning experiences and instruction

The final stage determines what instructional strategies and learning activities best support the learning objectives and assessment methods [54]. Hence, instructional strategies and teaching procedures, including key concepts and different activities to realize the SDGs, were incorporated into the design.

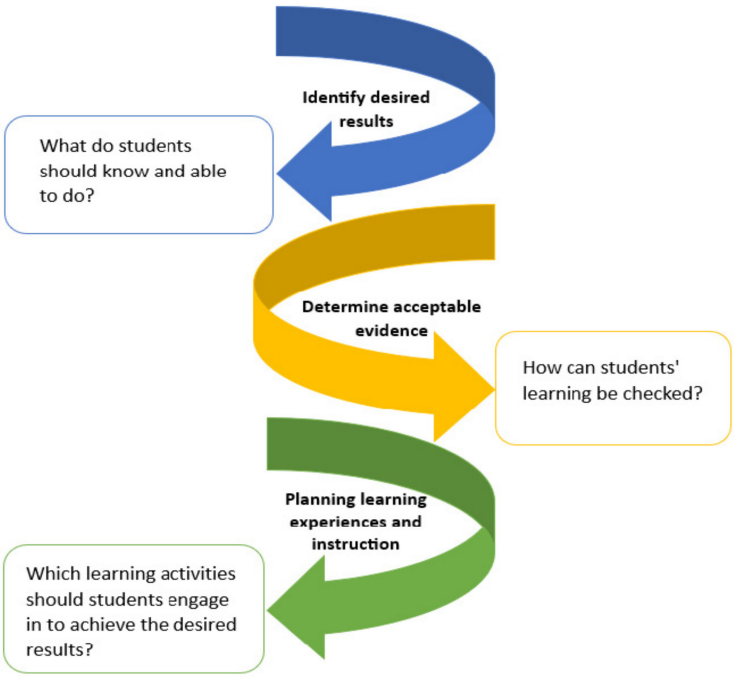


Figure 3. The backward design process [54].

After the unit was developed, experts' opinions were obtained. One of the experts is a researcher who has experience in education for sustainable development and has also undertaken research in the field. Another expert is an experienced science teacher who has taught sustainable development issues in middle schools. The other expert is a curriculum developer (see Table 1). After receiving experts' opinions in a pilot study, a part of the unit was trialed to assess its applicability in terms of learning objectives, assessments tasks, learning activities and their compatibility with each other. Students' views about learning activities were also received. Finally, experts', the science teacher's, and students' common views and suggestions on the unit, and the results of the pilot study were evaluated. The level and amount of information that are taught about each SDG and some of the classroom activities were rearranged and the latest version of the unit was designed.

Table 1. Experts' information.

Experts	Title	Experience	Scope of Views
1	Assistant professor	She has twelve years of research experience in education on sustainable development, the Sustainable Development Goals, and sustainability.	Views were received about the design of the SDG unit (learning objectives and activities, teaching approach).
2	Curriculum development specialist	She has ten years of research experience in the development of units at the middle school level.	Views were received about the steps of the unit development process.
3	Science teacher	She has ten years of teaching experience in sustainable development issues at the middle school level.	Views were received about the suitability and applicability of the unit for middle school levels and the readiness of students for this unit.

3.3. Implementation

The implementation of the Sustainable Development Goals unit lasted 10 weeks. In the first week of the "Environmental education and climate change" course, semi-structured interviews were conducted with 20 7th grade students to determine their knowledge about the SDGs. The science teacher began implementing the Sustainable Development Goals unit in the second week of class. The study's implementation phase lasted for eight weeks, 2–3 h per week. During these 8 weeks, students were taught each SDG based on a learn–think–act approach (see Table 2). Following the completion of the unit, students were asked to participate in another semi-structured interview to gauge their SDG knowledge.

Table 2. Sustainable Development Goals unit implementation process.

Week	Implementation	Teaching Approach
1	Data collection (semi-structured interview)	
2 (2 lesson hours)	Introducing sustainable development and Sustainable Development Goals	**Learn:** Theoretical knowledge about the SDGs was taught to students by teacher. **Think:** Students created different learning activities to think critically about the SDGs. **Act:** Students found ways to use their learning themselves and act on the SDGs in meaningful and appropriate ways.
3 (3 lesson hours)	(1) No poverty (2) Zero hunger (3) Good health and well-being	
4 (3 lesson hours)	(4) Quality education (5) Gender equality (6) Clean water and sanitation	
5 (3 lesson hours)	(7) Affordable and clean energy (8) Decent work and economic growth (9) Industry, innovation and infrastructure	
6 (2 lesson hours)	(10) Reduced inequalities (11) Sustainable cities and communities	
7 (2 lesson hours)	(12) Responsible consumption and production (13) Climate action	
8 (2 lesson hours)	(14) Life below water (15) Life on land	
9 (2 lesson hours)	(16) Peace, justice and institutions (17) Partnerships for goals	
10	Data collection (semi-structured interview)	

3.4. Research Group

The Sustainable Development Goals unit was developed and implemented with 20 7th grade students enrolled on the "Environmental education and climate change" elective course given at a public school in Istanbul, Turkey. The research group consisted of 10 boys and 10 girls. All students were receiving education on the Sustainable Development Goals for the first time. They and their parents gave consent to participate in this study.

3.5. Data Collection

The data were collected through semi-structured interviews with the students. The interview questions were developed by the researchers (see Appendix A). In order to be sure of the validity and reliability of the questions the researcher prepared for the semi-structured interview, experts' opinions were received in terms of applicability and suitability for grade level and the questions were applied to some non-participating students to assess whether they understood the questions or not. Thereafter, the semi-structured interviews were conducted with each student in the research sample. Interviews lasted approximately 20–30 min before unit implementation and lasted approximately 40–50 min after unit implementation. The semi-structured interviews were conducted by the same researcher before and after implementation for reliability and validity. The students' responses to questions were recorded by the researcher during the interviews.

3.6. Data Analysis

The recorded data were transcribed and analyzed with rubrics adopted from the context of the Sustainable Development Goals produced by the United Nations [7]. Deductive content analysis was used in data analysis [55]. This approach is a systematic research method that enables the researcher to analyze and make inferences about different forms of qualitative information such as that obtained from interviews, focus groups, documents, etc. In addition, this type of analysis includes an a priori design with parameters that were defined by researchers for coding information and content into categories that were classified based on a specified coding procedure [56,57]. During the data analysis process, students' SDG knowledge was classified as poor or good based on the rubric proposed in the relevant literature [25,26]. According to this classification, students' knowledge about the SDGs was determined to be poor if they gave no explanation about the SDGs while students' knowledge about the SDGs was marked as good if they could explain the definition and aim of the SDGs. In the current study, in order to be sure about inter-coder reliability, students' SDG knowledge was examined independently by the researchers according to the rubrics. Inter-coder reliability was 95% for SDG knowledge in this research.

4. Results

In the current study, a learn–think–act approach-based Sustainable Development Goals unit was developed and the effect of this unit on middle school students' SDG knowledge was explored. The results are presented under separate headings for the two main areas of research: (1) the latest version of a learn–think–act approach-based Sustainable Development Goals unit, and (2) results on students' pre–post knowledge about the SDGs.

4.1. The Latest Version of a Learn–Think–Act Approach-Based Sustainable Development Goals Unit

In the present study, a learn–think–act approach-based Sustainable Development Goals unit was developed for middle school students. Table 3 shows a part of the developed Sustainable Development Goals unit (see Appendix B for the whole unit). This unit is based on a learn–think–act pedagogical approach and includes learning objectives for each part of the approach. The "learn" part involves theoretical knowledge about the SDGs and different instructional videos. The "think" part includes practical educational resources such as different cases and learning activities about the 17 SDGs to make students think

critically. The "act" part covers different videos and learning activities about action and reflection. The aim of this unit is to raise students' knowledge about the SDGs as global citizens to achieve the Sustainable Development Goals by 2030.

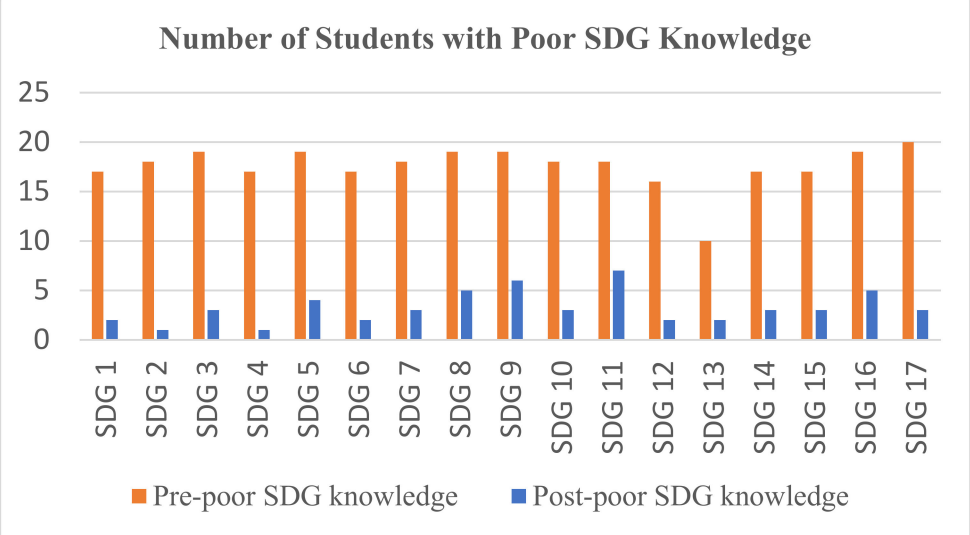
Table 3. A part of the Sustainable Development Goals unit.

SDG	Learn	Think	Act
SDG 1-No poverty	**Cognitive Learning Objective:** Students explain the concept of poverty, distributions of poverty, causes and impacts of poverty.	**Socio-Emotional Learning Objective:** Students discuss their own role and responsibilities for no poverty.	**Behavioral learning objective:** Students propose local and global solutions for no poverty.
	Background **Videos:** Understand SDG 1: No Poverty https://www.youtube.com/watch?v=A2O1HU6FMfk accessed on 20 January 2023 https://www.youtube.com/watch?v=T7qiM0quEf4&t=2s accessed on 2 February 2023	**Classroom Activity:** The world resources are not fairly and equally distributed!	**Activity:** What can you do to end poverty? **Videos:** Take Action on SDG 1: No Poverty https://www.youtube.com/watch?v=VbYXMxeRoAc accessed on 20 January 2023 https://www.youtube.com/watch?v=T66qWMHg83c accessed on 20 January 2023

4.2. Results on Students' Pre–Post Knowledge about the SDGs

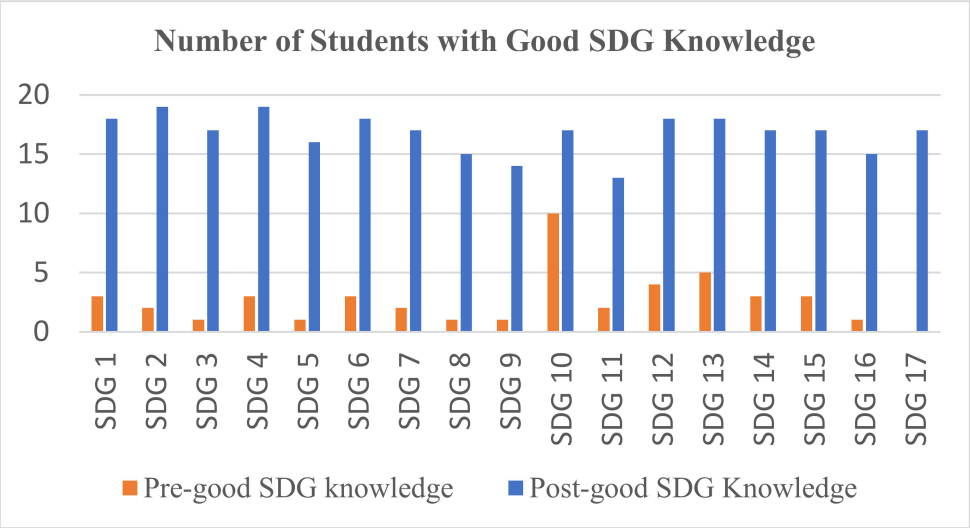
The results demonstrated that a learn–think–act approach-based Sustainable Development Goals unit was an effective curricular means of improving middle school students' knowledge about the SDGs.

Scheme 1 shows the number of students who had poor knowledge about the SDGs before and after the SDG unit implementation. According to the results, most students had poor knowledge about the SDGs prior to the unit implementation. After the unit implementation, the number of students who had poor knowledge about the SDGs decreased significantly.



Scheme 1. Number of students with poor SDG knowledge.

Scheme 2 shows the number of students who had good SDG knowledge before and after the unit implementation. According to the results, most students developed their SDG knowledge and had good SDG knowledge after the unit implementation. After the unit implementation, the number of students who had good knowledge about the SDGs increased significantly.



Scheme 2. Number of students with good SDG knowledge.

The detailed results on middle school students' pre–post knowledge about each SDG are presented under separate subheadings for 17 SDGs.

4.2.1. Results on Students' SDG 1 Knowledge

In order to determine students' SDG 1 knowledge, the question "What comes to your mind when the goal of 'No poverty' is stated? Please explain" was asked. It was expected that students would be able to explain the definition and aim of SDG 1. According to the results, most students (17) had poor knowledge about SDG 1 (No poverty) before the unit implementation. After the unit implementation, most students had developed their knowledge about SDG 1, and 18 out of 20 had good knowledge about "No poverty." For instance, the pre–post responses of student 3 about SDG 1 were as follows:

> *ST 3: I did not hear sustainable development goals. I think, poverty means not having money (Pre) (Poor).*
>
> *ST 3: There are people who do not have enough income to meet all or most of their daily basic needs in different parts of the world. With SDG 1, we can do something to end poverty all over the world by 2030. For example, instead of wasting our leftover food, we can deliver it to people who need it. The world resources should be equally and fairly distributed to all people. The goal of "no poverty" aims to find solutions for different kinds of poverty (Post) (Good).*

As understood from the statements of student 3, many students had poor knowledge about SDG 1 before the unit implementation and they could not properly define the concept of poverty or the aim of SDG 1. After the unit implementation, most of them could explain what poverty means, why eradicating it in all its forms everywhere is important, and what they could do to achieve this goal.

4.2.2. Results on Students' SDG 2 Knowledge

Students' SDG 2 knowledge was assessed with the question "What comes to your mind when the goal of 'Zero hunger' is stated? Please explain." It was expected that students would be able to explain the definition and aim of SDG 2. The results showed that most of the students (18) had poor knowledge about SDG 2 (Zero hunger) before the unit implementation. After the SDG unit implementation, 19 of them achieved a good level of SDG 2 knowledge. For example, pre–post quotes of student 8 about SDG 2 were as follows:

> *ST 8: Hunger means lack of food. I don't know the goal of "Zero hunger" (Pre) (Poor).*
>
> *ST8: In some parts of the world, people cannot access food, cannot eat healthy food and consequently get sick. Some people are not able to reach the sufficient amount of*

food necessary to sustain their lives due to the fact that we take more food on our plate than necessary and throw it away because we cannot eat it. We can contribute to the achievement of SDG 2 if we don't waste food. SDG 2 aims to end hunger for all people and children and this is an important goal, I think (Post) (Good).

Similar to student 8's responses, many students were familiar with the concept of hunger, but had poor knowledge about SDG 2 before the unit implementation and could not properly define the concept of hunger or the aim of SDG 2. After the unit implementation, they were able to explain what hunger means, why ending all forms of hunger and malnutrition is important, and what they can do to achieve this goal.

4.2.3. Results on Students' SDG 3 Knowledge

The question "What comes to your mind when the goal of 'Good health and well-being' is stated? Please explain" was asked to determine students' knowledge about SDG 3. It was expected that students would be able to explain the definition and aim of SDG 3. The findings revealed that most students (19) had had poor knowledge about SDG 3 (Good health and well-being) before the unit implementation. Thanks to the SDG unit, 17 developed good knowledge about SDG 3 after the unit implementation. Pre–post excerpts of student 7 about SDG 3 were as follows:

ST7: I guess, good health means being healthy (Pre) (Poor).

ST 7: In some parts of the world, people may not live healthy lives because of many reasons for example, they may not have access to health services. All people should be able to meet their health needs and lead a quality life. For instance, I try to contribute to vaccination practices for health. I help to prevent epidemics. I inform people about health issues. There are pandemics like COVID-19 in the world and people do not have hospitals to be treated. SDG 3 promotes healthy lives and well-being (Post) (Good).

Like quotes of student 7, many students had poor knowledge about SDG 3 before the unit implementation and they could not properly define the concept of good health or well-being or the aim of SDG 3. After the unit implementation, they became able to explain what good health and well-being means, why ensuring healthy lives and well-being for all is crucial, and what they can do to achieve this goal.

4.2.4. Results on Students' SDG 4 Knowledge

By asking the question "What comes to your mind when the goal of 'Quality education' is stated? Please explain," students' knowledge about SDG 4 was determined. It was expected that students would be able to explain the definition and aim of SDG 4. According to the results, there were 17 students who had poor knowledge about SDG 4 (Quality education) before the unit implementation. After teaching the SDGs with the unit, 19 students developed a good level of knowledge about SDG 4. Examples of student 1's pre–post quotes about SDG 4 are given below:

ST 1: Quality education refers to good education (Pre) (Poor).

ST 1: Education should be good quality and everyone should be able to benefit equally. In some parts of the world, girls cannot go to school. There is inequality between men and women. With SDG 4, both girls and boys can reach inclusive and equitable quality education. The goal of quality education is to provide lifelong learning opportunities for people all around the world (Post) (Good).

Similar to the excerpts of student 1, many students had poor knowledge about SDG 4 before the unit implementation and they could not properly define the concept of quality education or the aim of SDG 4. After the unit implementation, they were able explain what quality education means, why ensuring inclusive and equitable quality education and lifelong learning opportunities for all is important, and what they can do to achieve this goal.

4.2.5. Results on Students' SDG 5 Knowledge

In order to determine students' SDG 5 knowledge, the question "What comes to your mind when the goal of 'Gender equality' is stated? Please explain" was asked. It was expected that students would be able to explain the definition and aim of SDG 5. According to the results, most students (19) did not have knowledge about SDG 5 (Gender equality) before the unit implementation. The unit developed students' knowledge about gender equality. A total of 16 students gained good knowledge about SDG 5 with the unit implementation. To illustrate, student 15's pre–post statements about SDG 5 were as follows:

> *ST 15: It means that men and women are equal. This goal aims to ensure equality (Pre) (Poor).*
>
> *ST 15: The inequality between men and women, which has existed for a long time and still continues, must come to an end. Both genders should have equal rights without discrimination between men and women. For the world to be a better place, all people should be fair and equal. SDG 5 is important for achieving this equality. Discrimination between men and women should be prevented. SDG 5 is about this issue (Post) (Good).*

Similar to student 15's excerpts, many students had poor knowledge about SDG 5 before the unit implementation and they could not properly define the concept of gender equality or the aim of SDG 5. After the unit implementation, they became able to explain what gender equality means, why gender equality and supporting all women and girls is important, and what they can do to achieve this goal.

4.2.6. Results on Students' SDG 6 Knowledge

Students' SDG 6 knowledge was assessed with the question "What comes to your mind when the goal of 'Clean water and sanitation' is stated? Please explain." It was expected that students would be able to explain the definition and aim of SDG 6. According to the results, most of the students (17) had poor knowledge about SDG 6 (Clean water and sanitation) before the unit implementation. After the unit implementation, 18 students had developed good knowledge about SDG 6. For instance, student 5's pre–post responses about SDG 6 were as follows:

> *ST 5: Clean water means water that is not polluted. I don't know what the sanitation is (Pre) (Poor).*
>
> *ST 5: Especially in countries like Africa, people do not have access to clean water. Clean water is the right of every person and every person should have access to clean water in a clean way, and every person should be provided with sufficient water. Sanitation relates to providing clean and safe drinking water for everyone. I can use water carefully. I try to use water sparingly, for example, I do not let water run unnecessarily while washing my hands or brushing my teeth. SDG 6 ensures access to clean water and sanitation for all and this goal should be achieved because not accessing clean water is a very difficult situation and this can cause people to get sick or even die (Post) (Good).*

Before the unit implementation, many students had had poor knowledge about SDG 6, as understood from the responses of student 5. They could not properly define the concept of clean water and sanitation or the aim of SDG 6. After the unit implementation, they were able to explain what clean water and sanitation means, why ensuring availability of water and sanitation for all is important, and what they can do to achieve this goal.

4.2.7. Results on Students' SDG 7 Knowledge

The question "What comes to your mind when the goal of 'Affordable and clean energy' is stated? Please explain" was asked to determine students' knowledge about SDG 7. It was expected that students would be able to explain the definition and aim of SDG 7. According to the results, most of the students (18) had poor knowledge about SDG 7 (Affordable and clean energy) before the unit implementation. The unit developed students'

knowledge about SDG 7. Most students (17) became able to explain SDG7 after SDG unit implementation. To exemplify, student 12's pre–post quotes about SDG 7 were as follows:

> *ST 12: Energy, for example, natural gas, heat, electric. I don't know the meaning of clean energy (Pre) (Poor).*
>
> *ST12: Energy is necessary to live in today's world. Everyone has the right to access equal and clean energy. Clean energy is renewable energy with zero emission sources that is, not polluting the atmosphere and environment such as wind energy, solar energy, geothermal and hydropower, etc. By 2030, it is important that people use renewable energy (solar energy, wind energy, etc.) in a balanced way and enable everyone in the world to have clean energy according to SDG 7 (Post) (Good).*

As understood from the statements of student 12, many students had had poor knowledge about SDG 7 before the unit implementation and they could not properly define the concept of affordable and clean energy or the aim of SDG 7. After the unit implementation, most students could explain what affordable and clean energy means, why having access to affordable, sustainable, renewable energy for all is important, and what they can do to achieve this goal.

4.2.8. Results on Students' SDG 8 Knowledge

By asking the question "What comes to your mind when the goal of 'Decent work and economic growth' is stated? Please explain," the students' knowledge about SDG 8 was determined. It was expected that students would be able to explain the definition and aim of SDG 8. The results showed that students (19) had poor knowledge about SDG 8 (Decent work and economic growth) before the unit implementation. After the unit implementation, 15 of them had developed good knowledge about SDG 8. For example, the pre–post excerpts of student 20 about SDG 8 are below:

> *ST20: I have not heard about sustainable development goals but I think that economic growth means the development of economy (Pre) (Poor).*
>
> *ST20: When people find suitable and decent jobs for themselves, they can contribute to the growth and enrichment of the economy. Most people in the world have to do jobs they hate. Doing what they love is important for the efficiency and recovery of the economy. It is aimed with SDG 8 that all people have productive employment and decent work, and economic growth should be promoted (Post) (Good).*

Before the unit implementation, many students had poor knowledge about SDG 8, as understood from the responses of student 20. They could not properly define the concept of decent work and economic growth or the aim of SDG 8. After the unit implementation, they could explain what decent work and economic growth means, why promoting economic growth and decent work for all is important, and what they can do to achieve this goal.

4.2.9. Results on Students' SDG 9 Knowledge

With the aim of determining students' SDG 9 knowledge, the question "What comes to your mind when the goal of 'Industry, innovation and infrastructure' is stated? Please explain" was asked. It was expected that the students would be able to explain the definition and aim of SDG 9. The results showed that before the implementation, there were 19 students with poor knowledge about SDG 9 (Industry, innovation and infrastructure). By teaching the SDGs, 14 of them developed good knowledge. For instance, student 16's pre–post quotes about SDG 9 were as follows:

> *ST 16: I have no idea about infrastructure. Innovation means new things. Industry relates to economy (Pre) (Poor).*
>
> *ST 16: It is important for the world to develop the industry, to be open to innovations, and to have a sustainable infrastructure. This is important in every field like economic, environment and social life. For example, the country's health infrastructure should be*

good. People's houses should be built to have earthquake resistant infrastructure. Technological progress is also important for countries. Developing the industry is important for economic growth. I can develop myself and become equipped with skills and innovate in many fields. With SDG 9, industry, innovation and infrastructure may be promoted (Post) (Good).

Similar to student 16's excerpts, many students had poor knowledge about SDG 9 before the unit implementation and they could not properly define the concepts of industry, innovation and infrastructure or the aim of SDG 9. After the unit implementation, they were able to explain what industry, innovation and infrastructure means, why promoting industrialization, fostering innovation and building a strong infrastructure is important, and what they can do to achieve this goal.

4.2.10. Results on Students' SDG 10 Knowledge

The question "What comes to your mind when the goal of 'Reduced inequalities' is stated? Please explain" was asked to determine students' knowledge about SDG 10. It was expected that students would be able to explain the definition and aim of SDG 10. According to the results, most students (18) did not have knowledge about SDG 10 (Reduced inequalities) before the unit implementation. After the unit implementation, 17 students seemed to have good knowledge about SDG 10. Examples of student 4's pre–post quotes about SDG 10 were as follows:

ST 4: Reducing inequalities between women and men comes to my mind (Pre) (Poor).

ST 4: There are different kinds of inequalities like income, sex, age, disability, race, class, ethnicity, religion and opportunity across the world. For example, women face inequalities in many ways. That is, women are exposed to violence, economic inequalities, for example, they do not get equal salaries even though they do the same job as men. In addition, while men are given opportunities to work in every field of work, women are not employed in some jobs. In some regions of the world, women, children and black people are exposed to inequality and injustice. With SDG 10, it is aimed to reduce all types of inequalities in both our country and other countries (Post) (Good).

Similar to the quotes of student 4, many students had poor knowledge about SDG 10 before the unit implementation and they could not properly define the concept of reduced inequalities or the aim of SDG 10. After the unit implementation, they were able to explain what reduced inequalities means, why reducing inequality within and among countries is crucial, and what they can do to achieve this goal.

4.2.11. Results on Students' SDG 11 Knowledge

Students' SDG 11 knowledge was assessed with the question "What comes to your mind when the goal of 'Sustainable cities and communities' is stated? Please explain." It was expected that students would be able to explain the definition and aim of SDG 11. According to the results, most students (18) did not have enough knowledge about SDG 11 (Sustainable cities and communities) before the unit implementation. After the unit, 13 students had developed a good knowledge level. To illustrate, student 9's pre–post statements about SDG 11 are given below:

ST 9: It may be durable cities and communities (Pre) (Poor).

ST 9: Nature-friendly houses that do not harm the living conditions of future generations should be built; sustainable cities should be established because future generations also deserve a good life. Sustainable cities, that is, homes that produce their own energy, homes with solar panels are important for all people and our planet. For example, such cities are established in some countries like Japan. SDG 11 is about making cities and human settlements safe, resilient and sustainable (Post) (Good).

As understood from the statements of student 9, many students had poor knowledge about SDG 11 before the unit implementation and they could not define the concept of

sustainable cities and communities or the aim of SDG 11. After the unit implementation, most of the students could explain what sustainable cities and communities mean, why making cities and human settlements sustainable is important, and what they can do to achieve SDG 11.

4.2.12. Results on Students' SDG 12 Knowledge

In order to determine students' SDG 12 knowledge, the question "What comes to your mind when the goal of 'Responsible consumption and production' is stated? Please explain" was asked. It was expected that students would be able to explain the definition and aim of SDG 12. The findings revealed that most of the students (16) had poor knowledge about SDG 12 (Responsible consumption and production) before the unit implementation. With the unit implementation, 18 students developed good knowledge about responsible consumption and production. Examples of student 11's pre–post responses about SDG 12 were as follows:

> *ST 11: being careful while consuming and producing (Pre) (Poor).*
>
> *ST 11: We must pass on resources for the lives of future generations. We must not waste our resources. So we should consume our resources sparingly. People consume more than necessary. We must produce and consume responsibly. It is very important that we reduce, recycle, and reuse. SDG 12 is about responsible consumption and production. It is important that people in the future have the resources we have today and live comfortably (Post) (Good).*

Similar to student 11's excerpts, many students had had poor knowledge about SDG 12 before the unit implementation and they could not properly define the concept of responsible consumption and production or the aim of SDG 12. After the unit implementation, they became able to explain what responsible consumption and production means, why ensuring sustainable consumption and production is vital, and what they can do to achieve this goal.

4.2.13. Results on Students' SDG 13 Knowledge

With the aim of determining students' SDG 13 knowledge, the question "What comes to your mind when the goal of 'Climate action' is stated? Please explain" was asked. It was expected that students would be able to explain the definition and aim of SDG 13. According to the results, half of the students (10) had poor knowledge about SDG 13 (Climate action) before the unit implementation. After the unit, 18 students showed improved knowledge about climate action to a good level. To exemplify, pre–post excerpts of student 6 about SDG 13 were as follows:

> *ST6: Climate change means changing seasons, experiencing winter when it is summer, and experiencing summer when it is winter (Pre) (Poor).*
>
> *ST6: Due to the unconscious behavior of people and the constant use of artificial things and destroying natural resources and our environment, the sun's rays are not reflected from the earth due to gases in Earth's atmosphere which traps the Sun's heat. Therefore, greenhouse effect and global warming occur and glaciers melt. Climate change happens because of global warming. Climate change is caused by our activities and threatens life on earth. We should take precautions. For example, I try to clean up the environment, walk instead of using transportation, raise people" awareness about climate change. Achieving SDG 13 is crucial to sustain our world (Post) (Good).*

Before the unit implementation, half of the students had poor knowledge about SDG 13, as understood from the responses of student 6. They could not properly define the concept of climate action or the aim of SDG 13. After the unit implementation, they were able to explain what climate action means, why taking urgent action for climate change and its effects is crucial, and what they can do to achieve goal 13.

4.2.14. Results on Students' SDG 14 Knowledge

By asking the question "What comes to your mind when the goal of 'Life below water' is stated? Please explain," students' knowledge about SDG 14 was determined. It was expected that students would be able to explain the definition and aim of SDG 14. According to the results, most students (17) did not have enough knowledge about SDG 14 (Life below water) before the unit implementation. After the unit implementation, 17 students had developed good knowledge. Examples of student 18's pre–post quotes about SDG 14 are given below:

ST18: Aquatic creatures like fish, whales, etc. come to my mind (Pre) (Poor).

ST18: Garbage and waste are always thrown into the seas, oceans and lakes by people. Moreover, harmful wastes of factories mix with seas, lakes or oceans. Many species living here become harmed. Because of the harmful things people use (such as plastic, etc.), the life of aquatic creatures is endangered, or they become extinct, and a bad appearance or odor occurs in the seas due to pollution. And all of these can mix with our drinking water and affect our waters. In addition, overfishing endangers the survival of species. In order for aquatic creatures to survive, we must protect our waters and all those living below water. We should protect life below water. SDG 14 is vital for life below water (Post) (Good).

As understood from the statements of student 18, many students had poor knowledge about SDG 14 before the unit implementation and they could not define the concept of life below water or the aim of SDG 14. After the unit implementation, most of the students were able to explain what life below water means, why protecting oceans, seas and marine resources for sustainable development is important, and what they can do to achieve this goal.

4.2.15. Results on Students' SDG 15 Knowledge

The question "What comes to your mind when the goal of 'Life on land' is stated? Please explain" was asked to determine students' knowledge about SDG 15. It was expected that students would be able to explain the definition and aim of SDG 15. According to the results, most students (17) had poor knowledge about SDG 15 (Life on land) before the unit implementation. After the unit implementation, 17 students gained good knowledge about SDG 15. For instance, pre–post examples of student 13's responses about SDG 15 were as follows:

ST 13: I think of all those living on the land. People, animals, plants (Pre) (Poor).

ST 13: People leave their waste in their environment. Factories pollute the air by releasing harmful gases. Living things on land are harmed by this pollution. For example, when people leave behind glass waste in forests, these can cause fire. Many animals living in the forest die. Humans cause great harm to terrestrial life. With SDG 15, we can protect terrestrial ecosystems, soils, forests, biodiversity (Post) (Good).

Similar to student 13's excerpts, many others had had poor knowledge about SDG 15 before the unit implementation and they could not properly define the concept of life on land or the aim of SDG 15. After the unit implementation, they were able to explain what life on land actually means, why protecting terrestrial ecosystems, forests, biodiversity is important, and what they can do to achieve SDG 15.

4.2.16. Results on Students' SDG 16 Knowledge

Students' SDG 16 knowledge was assessed with the question "What comes to your mind when the goal of 'Peace, justice and strong institutions' is stated? Please explain." It was expected that students would be able to explain the definition and aim of SDG 16. According to the results, students (19) had poor knowledge about SDG 16 (Peace, justice and strong institutions) before the unit implementation. Thanks to the unit implementation,

15 students gained good knowledge. For example, the pre–post excerpts of student 2 about SDG 16 are given below:

ST 2: Living in peace without war. We should live in peace (Pre) (Poor).

ST 2: People and future generations have the right to live in peace and in good times. Law, justice, and equality are important factors to live peacefully. Peace and justice should spread all over the world. We must work to spread peace and justice to the world. To do this, we need strong institutions which are effective, accountable and inclusive for all. SDG 16 aims to build peace, justice and strong institutions (Post) (Good).

Before the unit implementation, many students had poor knowledge about SDG 16 as understood from the responses of student 2. They could not properly define the concept of peace, justice and strong institutions or the aim of SDG 16. After the unit implementation, they were able to explain what peace, justice and strong institutions means, why promoting peace, justice and strong institutions for all is important, and what they can do to achieve this goal.

4.2.17. Results on Students' SDG 17 Knowledge

With the aim of determining students' SDG 17 knowledge, the question "What comes to your mind when the goal of 'Partnerships for goals' is stated? Please explain" was asked. It was expected that students would be able to explain the definition and aim of SDG 17. According to the results, all students (20) had poor knowledge about SDG 17 (Partnerships for goals) before the SDG unit. After the unit implementation, 17 students developed good knowledge about SDG 17. Examples of student 14's quotes about SDG 16 are as follows:

ST 14: I have no idea about partnerships for goals. It may mean working together for a goal (Pre) (Poor).

ST 14: By 2030, we need to achieve all sustainable development goals by acting together with all countries all over the world. We must unite and become partners to achieve sustainable development goals. SDG 17 relates to this and is crucial to achieve all goals (Post) (Good).

Similar to the quotes of student 14, all students had had poor knowledge about SDG 17 before the unit implementation and they could not properly define the concept of partnerships for goals or the aim of SDG 17. After the unit implementation, they became able to explain what partnerships for goals means, why strengthening the means of implementation and revitalizing the global partnership for sustainable development is important, and what they can do to achieve this goal.

5. Discussion and Conclusions

In the current research, a learn–think–act approach-based Sustainable Development Goals unit was developed and the effect of this unit on middle school students' knowledge about the SDGs was explored. The aim of developing this unit is to introduce the SDGs to middle school students and raise them as well-informed global citizens for the purpose of achieving the Sustainable Development Goals. This unit was devised using a learn–think–act pedagogical approach, which is a compatible approach for teaching the SDGs. The unit includes learning objectives (cognitive, socio-emotional and behavioral) for each SDG. Theoretical information about the SDGs and practical educational resources (different cases and learning activities) about 17 SDGs were designed to be compatible with the learning objectives of each SDG. The unit improved SDG knowledge by equipping students with theoretical knowledge about the SDGs as well as making students think critically on global issues and find solutions about global challenges through different classroom activities and cases. Prior to application of the unit, students' knowledge about all the SDGs was seen as limited and poor. After the learn–think–act approach-based Sustainable Development Goals unit implementation, students were assessed to have good knowledge and were able to explain what the Sustainable Development Goals are, why the achievement of all the

SDGs is crucial and what they can do to help in achieving them. Similar to the findings of the present study, Yuan et al. [58] also showed in their research that senior high school students' knowledge about the SDGs was limited and emphasized that implementation of education for sustainable development can enhance students' awareness, knowledge and competencies regarding the SDGs. Leiva-Brondo et al. [23] revealed that primary students had an average level of knowledge about the SDGs and classroom activities can increase SDG knowledge and experiments related to life development. García-González et al. [10] showed in their study that student teachers' knowledge of the Sustainable Development Goals can be improved with education for Sustainable Development Goals. Vasconcelos et al. [59] demonstrated that the case-based teaching improved university students' knowledge of the Sustainable Development Goals. Similarly, Oltra-Badenes et al. [60] proved that a series of teaching–learning activities can improve the degree of SDG knowledge of students.

Many previous studies have generally considered the implementation of the SDGs at higher education levels [16,21,22,61–65]. These revealed that the knowledge, attitudes, and perceptions of university students regarding the SDGs and how the university can contribute to SDG education and higher education play an important role in the new global development agenda. While SDG implementation at university level is important, it is thought crucial to start SDG education at the elementary level as well if we are to raise children as global citizens, capable of realizing the local and global challenges and developing insights and solutions for issues around the world [44]. Encabo-Fernández et al. [66] emphasized that there is general lack of student knowledge about the SDGs and that little consideration is given to the treatment of the SDGs in schools. Education at K-12 levels has an important role to play in raising knowledge and awareness of the SDGs and in teaching skills, competencies and values that lead to more sustainable behavior [67–69]. However, there is insufficient research about the implementation of the SDGs and only a few scattered studies present how SDG knowledge can be integrated with K-12 curricula [32,70]. Given this gap in the knowledge of the implementation of the SDGs at K-12 level, this research aimed to develop a curriculum resource (the unit) to educate students about the SDGs, which were conceived to provide a global road map for transforming our world and redirect humanity to a sustainable path now and in the future. Moreover, this study makes innovative contributions to the relevant literature about education for the Sustainable Development Goals for the development of middle school students' SDG knowledge. In future studies, experimental research designs also can be conducted to compare the effectiveness of the SDG unit on students' knowledge, awareness, attitudes, and behaviors or other variables. In addition, it can be focused to develop or adapt SDG units for preschool and primary school students because curriculum materials are also strongly needed to teach the SDGs at early ages.

Teaching the SDGs at early age is considered extremely important, and apparently will become more so as time goes on and as global resources are depleted. Such education is vital to preparing the next generation to cope with complex issues like poverty, hunger, inequality, and climate change alongside many other emerging challenges. Thanks to the SDGs, students can gain a better understanding of the local and global issues we are facing and why we all need to take actions to secure a better future for both ourselves and future generations. Teaching the SDGs is the main method of bringing global learning into the classroom. It helps students to understand global issues at local level and gives them deeper understanding of the world, how it functions, and their place in it. By learning about the SDGs, students can better understand how their actions can contribute to a more sustainable future. SDG education in schools can promote the learning of skills, perspectives, and values needed to foster a sustainable society [71]. By introducing the SDGs to students at middle schools, teachers can help them build a better understanding of how their actions can contribute to the achievement of these goals. This can help students to develop a sense of social responsibility, empowering them to take an active role in creating a sustainable future. Addressing sustainable development goals in schools requires the willingness of education leaders and stakeholders to adjust their curricula and engage interdisciplinary teaching with the goal of transformation of our world [67,72–74]. By

incorporating the SDG unit into the curriculum, we can help students gain the knowledge and skills they need to make a positive impact in their communities. This can help to create a better and sustainable future for all.

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Appendix A. Interview Questions

1. Have you ever heard of the concept of sustainable development? If yes, please explain.
2. Have you heard of the Sustainable Development Goals? If yes, how many goals are there, and what are they? please explain.
3. What comes to your mind when the goal of "No poverty" is stated? Please explain.
4. What comes to your mind when the goal of "Zero hunger" is stated? Please explain.
5. What comes to your mind when the goal of "Good health and well-being" is stated? Please explain.
6. What comes to your mind when the goal of "Quality education" is stated? Please explain.
7. What comes to your mind when the goal of "Gender equality" is stated? Please explain.
8. What comes to your mind when the goal of "Clean water and sanitation" is stated? Please explain.
9. What comes to your mind when the goal of "Affordable and clean energy" is stated? Please explain.
10. What comes to your mind when the goal of "Decent work and economic growth" is stated? Please explain.
11. What comes to your mind when the goal of "Industry, innovation, infrastructure" is stated? Please explain.
12. What comes to your mind when the goal of "Reduced inequalities" is stated? Please explain.
13. What comes to your mind when the goal of "Sustainable cities and communities" is stated? Please explain.
14. What comes to your mind when the goal of "Responsible consumption and production" is stated? Please explain.
15. What comes to your mind when the goal of "Climate action" is stated? Please explain.
16. What comes to your mind when the goal of "Life below water" is stated? Please explain.
17. What comes to your mind when the goal of "Life on land" is stated? Please explain.
18. What comes to your mind when the goal of "Peace, justice and strong institutions" is stated? Please explain.
19. What comes to your mind when the goal of "Partnerships for the goals" is stated? Please explain.

Appendix B. Sustainable Development Goals Unit

Week	Subject	Learn	Think	Act
1 (2 lesson hours)	Sustainable Development and Sustainable Development Goals	**Cognitive Learning Objective** Students explain the concept of sustainable development and what 17 SDGs are.	**Socio-emotional learning objective:** Students discuss their own role and responsibilities of achieving sustainable development and 17 goals.	**Behavioral learning objective:** Students propose local and global suggestions for achieving sustainable development and sustainable development goals.
		Background **Video:** What is sustainable development? https://www.youtube.com/watch?v=7V8oFI4GYMY&t=138s accessed on 20 January 2023 **Video:** Sustainable Development Goals: What are SDGs? https://www.youtube.com/watch?v=7dzFbP2AgFo accessed on 2 February 2023	**Classroom activity:** Let's meet sustainable development and Sustainable Development Goals!	**Classroom activity:** What are the biggest problems faced by people around the world today? What can you do for the world we want to live in?
2 (3 lesson hours)	SDG 1: No poverty	**Cognitive Learning Objective:** Students explain the concept of poverty, distributions of poverty, causes and impacts of poverty.	**Socio-emotional learning objective:** Students discuss their own role and responsibilities for no poverty.	**Behavioral learning objective:** Students propose local and global solutions for no poverty.
		Background **Videos:** Understand SDG 1: No Poverty https://www.youtube.com/watch?v=A2O1HU6FMfk accessed on 20 January 2023 https://www.youtube.com/watch?v=T7qiM0quEf4&t=2s accessed on 2 February 2023	**Classroom activity:** The world's resources are not fairly or equally distributed!	**Classroom activity:** What can you do to end poverty? **Videos:** Take Action on SDG 1: No Poverty https://www.youtube.com/watch?v=VbYXMxeRoAc accessed on 20 January 2023 https://www.youtube.com/watch?v=T66qWMHg83c accessed on 20 January 2023
	SDG 2: Zero hunger	**Cognitive Learning Objective** Students explain the concept of hunger, distributions of hunger, causes and impacts of hunger.	**Socio-emotional learning objective** Students discuss critically on their own role and responsibilities for zero hunger.	**Behavioral learning objective** Students propose local and global solutions for zero hunger.
		Background **Videos:** Understand SDG 2: Zero Hunger https://www.youtube.com/watch?v=JjE76M0a054 accessed on 20 January 2023 https://www.youtube.com/watch?v=ifCQ4LqT8G8 accessed on 2 February 2023	**Classroom activity:** What's on our plate? Every plate tells people" story [75].	**Classroom activity:** What can you do for zero hunger? **Videos:** Take Action on SDG 2: Zero Hunger https://www.youtube.com/watch?v=LuovkHAGios accessed on 20 January 2023 https://www.youtube.com/watch?v=1iUIKgcMDV4 accessed on 20 January 2023
	SDG 3: Good health and well-being	**Cognitive learning objective** Students explain the concepts of good health, hygiene and well-being and importance of good health and well-being.	**Socio-emotional learning objective** Students discuss their own role and responsibilities for good health and well-being for all.	**Behavioral learning objectives** Students propose suggestions for promoting good health and well-being.
		Background **Videos:** Understand SDG 3: Good Health and Well-Being https://www.youtube.com/watch?v=9qiVBF_7wvY accessed on 20 January 2023 https://www.youtube.com/watch?v=ARmBCl4nid0 accessed on 2 February 2023	**Classroom activity:** A healthy and prosperous life for everyone!	**Classroom activity:** What can you do for good health and well-being? **Video:** Take Action on SDG 3: Good Health and Well-Being https://www.youtube.com/watch?v=moLWJ1zzMPI accessed on 20 January 2023

Week	Subject	Learn	Think	Act
3 (3 lesson hours)	SDG 4: Quality education	**Cognitive learning objective** Students explain quality education and the important role of quality education and lifelong learning opportunities for all.	**Socio-emotional learning objective** Students communicate their own role and responsibilities for quality education.	**Behavioral learning objective** Students propose suggestions for quality education for all.
		Background **Videos:** Understand SDG 4: Quality Education https://www.youtube.com/watch?v=4HXyJmY--gM accessed on 20 January 2023 https://www.youtube.com/watch?v=LIExX9St4oA accessed on 2 February 2023	**Classroom activity:** Quality education can change and transform our world!	**Classroom activity:** What can you do for quality education? **Videos:** Take Action on SDG 4: Quality Education https://www.youtube.com/watch?v=mVvaGmdvdwo accessed on 20 January 2023 https://www.youtube.com/watch?v=AIMS9sNISOs accessed on 20 January 2023
	SDG 5: Gender equality	**Cognitive learning objective** Students explain the concept of gender, gender equality and gender discrimination, basic rights of women and girls and the importance.	**Socio-emotional learning objective** Students discuss their own role and responsibilities for gender equality.	**Behavioral learning objective** Students propose solutions for gender equality.
		Background **Videos:** Understand SDG 5: Gender Equality https://www.youtube.com/watch?v=vz7IUDOYvXk accessed on 20 January 2023 https://www.youtube.com/watch?v=F-OURmsmEKo accessed on 2 February 2023	**Classroom activity:** Everybody wins if gender equality exists all around the world!	**Classroom activity:** What can you do for gender equality? **Videos:** Take Action on SDG 5: Gender Equality https://www.youtube.com/watch?v=yMQX0y-D6Sg accessed on 20 January 2023 https://www.youtube.com/watch?v=j4Mcvb2MnOc accessed on 20 January 2023
	SDG 6: Clean water and sanitation	**Cognitive learning objective** Students explain the concepts of clean water and sanitation and the importance of water quality and quantity.	**Socio-emotional learning objective** Students communicate their own role and responsibilities for clean water and sanitation.	**Behavioral learning objective** Students propose solutions for reducing their individual water footprint and saving water resources.
		Background **Videos:** Understand SDG 6: Clean Water and Sanitation https://www.youtube.com/watch?v=7x2Ch-aMqEY accessed on 20 January 2023 https://www.youtube.com/watch?v=dpaUBRl8c6A&t=19s accessed on 2 February 2023	**Classroom activity:** Can you live with dirty water? Clean water for all!	**Classroom activity:** What can you do for clean water and sanitation? **Videos:** Take Action on SDG 6: Clean Water and Sanitation https://www.youtube.com/watch?v=00DrfwOwPHs accessed on 20 January 2023 https://www.youtube.com/watch?v=TVOFh-5dorc accessed on 20 January 2023

Week	Subject	Learn	Think	Act
4 (3 lesson hours)	SDG 7: Affordable and clean energy	**Cognitive learning objective** Students explain the concepts of affordable and clean energy, different energy resources—renewable and non-renewable— and their respective advantages and disadvantages.	**Socio-emotional learning objective** Students discuss their own role and responsibilities for affordable and clean energy, energy efficiency and sufficiency.	**Behavioral learning objective** Students propose solutions for affordable and clean energy, energy efficiency and sufficiency.
		Background **Videos:** Understand SDG 7: Affordable and Clean Energy https://www.youtube.com/watch?v=jlWfQoycRPE accessed on 20 January 2023 https://www.youtube.com/watch?v=lVgvK8Kfxwc accessed on 2 February 2023	**Classroom activity:** Let's use renewable energy!	**Classroom activity:** What can you do for affordable and clean energy? **Video:** Take Action on SDG 7: Affordable and Clean Energy https://www.youtube.com/watch?v=i6aQA8jJrxM accessed on 20 January 2023
	SDG 8: Decent work and economic growth	**Cognitive learning objective** Students explain the concepts of decent work and economic growth.	**Socio-emotional learning objective** Students discuss their own role and responsibilities for decent work and economic growth.	**Behavioral learning objective** Students propose suggestions for decent work and economic growth.
		Background **Videos:** Understand SDG 8: Decent Work and Economic Growth https://www.youtube.com/watch?v=JVBypZdv8qw accessed on 20 January 2023 https://www.youtube.com/watch?v=lj0JlrIWx2k accessed on 2 February 2023	**Classroom activity:** Decent work and economic growth for a better world!	**Classroom activity:** What can you do for decent work and economic growth? **Videos:** Take Action on SDG 8: Decent Work and Economic Growth https://www.youtube.com/watch?v=9c2hR3r7x6Q accessed on 20 January 2023 https://www.youtube.com/watch?v=xSzwWE3juS8 accessed on 20 January 2023
	SDG 9: Industry, innovation, and infrastructure	**Cognitive learning objective** Students explain the concepts of industry, innovation and sustainable infrastructure and industrialization.	**Socio-emotional learning objective** Students argue their own role and responsibilities for sustainable industry, innovation, and infrastructure.	**Behavioral learning objective** Students propose suggestions for sustainable industry, innovation and industrialization.
		Background **Videos:** Understand SDG 9: Industry, Innovation, and Infrastructure https://www.youtube.com/watch?v=HjX4rlMP-eg accessed on 20 January 2023 https://www.youtube.com/watch?v=J57rRolByqY&t=51s accessed on 2 February 2023	**Classroom activity:** The world's future: industry, innovation, and infrastructure!	**Classroom activity:** What can you do for industry, innovation, and infrastructure? **Videos:** Take Action on SDG 9: Industry, Innovation, and Infrastructure https://www.youtube.com/watch?v=7m-rqNHDdrM accessed on 20 January 2023 https://www.youtube.com/watch?v=Do7XUKaAdMI accessed on 20 January 2023

Week	Subject	Learn	Think	Act
5 (2 lesson hours)	SDG 10: Reduced inequalities	**Cognitive learning objective** Students explain the concept of different dimensions of inequality.	**Socio-emotional learning objective** Students discuss their own role and responsibilities for reducing inequalities.	**Behavioral learning objective** Students propose solutions for reducing inequalities.
		Background **Videos:** Understand SDG 10: Reduced Inequalities https://www.youtube.com/watch?v=6DlQq2xLw_0 accessed on 20 January 2023 https://www.youtube.com/watch?v=-5wo1ArN88w accessed on 2 February 2023	**Classroom activity:** We're not so different each other—Let's stand as one!	**Classroom activity:** What can you do for reducing inequalities? **Video:** Take Action on SDG 10: Reduced Inequalities https://www.youtube.com/watch?v=v2DADIIyhrM accessed on 20 January 2023
	SDG 11: Sustainable cities and communities	**Cognitive learning objective** Students explain the concepts of sustainable cities and communities.	**Socio-emotional learning objective** Students discuss their own role and responsibilities for sustainable cities and communities.	**Behavioral learning objective** Students propose suggestions for sustainable cities and communities.
		Background **Videos:** Understand SDG 11: Sustainable Cities and Communities https://www.youtube.com/watch?v=VrBrpSTwPK8 accessed on 20 January 2023 https://www.youtube.com/watch?v=7hEYtozmb5o accessed on 2 February 2023	**Classroom activity:** Build a dream city! Eco-friendly homes and sustainable living for everyone!	**Classroom activity:** What can you do for sustainable cities and communities? **Videos:** Take Action on SDG 11: Sustainable Cities and Communities https://www.youtube.com/watch?v=sPmPmMackUs accessed on 20 January 2023 https://www.youtube.com/watch?v=phyRNpV9asA accessed on 20 January 2023
6 (2 lesson hours)	SDG 12: Responsible consumption and production	**Cognitive learning objective** Students explain the concepts responsible consumption and production.	**Socio-emotional learning objective** Students communicate their own role and responsibilities for responsible consumption and production.	**Behavioral learning objective** Students propose solutions for responsible consumption and production.
		Background **Videos:** Understand SDG 12: Responsible Consumption and Production https://www.youtube.com/watch?v=2Ypif-QElok accessed on 20 January 2023 https://www.youtube.com/watch?v=dn-hLQk49eA accessed on 2 February 2023	**Classroom activity:** Reduce, reuse, recycle for a better life! Understanding the challenge of finite resources.	**Classroom activity:** What can you do for responsible consumption and production? **Videos:** Take Action on SDG 12: Responsible Consumption and Production https://www.youtube.com/watch?v=a5B2Sg-0lmM accessed on 20 January 2023 https://www.youtube.com/watch?v=gnZ5YbNKcqs accessed on 20 January 2023
	SDG 13: Climate action	**Cognitive learning objective** Students explain the concept of climate change.	**Socio-emotional learning objective** Students argue their own role and responsibilities for climate change.	**Behavioral learning objective** Students propose solutions for climate change.
		Background **Videos:** Understand SDG 13: Climate Action https://www.youtube.com/watch?v=6YqmEYlg4IY accessed on 20 January 2023 https://www.youtube.com/watch?v=jhoa3OHivN8 accessed on 2 February 2023	**Classroom activity:** Climate action: Let's calculate our carbon footprint!	**Classroom activity:** What can you do for climate action? **Videos:** Take Action on SDG 13: Climate Action https://www.youtube.com/watch?v=b61FPARMsv8 accessed on 20 January 2023 https://www.youtube.com/watch?v=ugWV-mx5h6o accessed on 20 January 2023

Week	Subject	Learn	Think	Act
7 (2 lesson hours)	SDG 14: Life below water	**Cognitive learning objective** Students explain life below water and its importance.	**Socio-emotional learning objective** Students communicate their own role and responsibilities for protecting life below water.	**Behavioral learning objective** Students propose solutions for protecting life below water.
		Background **Videos:** Understand SDG 14: Life below Water https://www.youtube.com/watch?v=muMwekvfmBY accessed on 20 January 2023 https://www.youtube.com/watch?v=u-l3KfmFNx0 accessed on 2 February 2023	**Classroom activity:** Marine litter—Protect life below water!	**Classroom activity:** What can you do for life below water? **Videos:** Take Action on SDG 14: Life Below Water https://www.youtube.com/watch?v=iatuNzxKDiw accessed on 20 January 2023 https://www.youtube.com/watch?v=dKhlPz1nNWM accessed on 20 January 2023
	SDG 15: Life on land	**Cognitive learning objective** Students explain life on land and its importance.	**Socio-emotional learning objective** Students communicate their own role and responsibilities for protecting life on land.	**Behavioral learning objective** Students propose solutions for protecting life on land.
		Background **Videos:** Understand SDG 15: Life on Land https://www.youtube.com/watch?v=qAfmUc7HJr0 accessed on 20 January 2023 https://www.youtube.com/watch?v=HRtua9GpzhY accessed on 2 February 2023	**Classroom activity:** Earth: It's everybody's home! The impact of pollution on our planet and our lives.	**Classroom activity:** What can you do to protect life on land? **Videos:** Take Action on SDG 15: Life on Land https://www.youtube.com/watch?v=zxYQYU9wTZU accessed on 20 January 2023 https://www.youtube.com/watch?v=FI9SewsqYP0 accessed on 20 January 2023
8 (2 lesson hours)	SDG 16: Peace, justice and strong institutions	**Cognitive learning objective** Students explain the concepts of peace, justice, and strong institutions.	**Socio-emotional learning objective** Students communicate their own roles and responsibilities for peace, justice, and strong institutions.	**Behavioral learning objective** Students propose suggestions for peace, justice, and strong institutions nationally and globally.
		Background **Videos:** Understand SDG 16: Peace, justice and strong institutions https://www.youtube.com/watch?v=AjwL5vWqp-Y accessed on 20 January 2023 https://www.youtube.com/watch?v=Ki33yMnfAso accessed on 2 February 2023	**Classroom activity:** The power of peace, justice, and strong institutions.	**Classroom activity:** What can you do for peace, justice, and strong institutions? **Videos:** Take Action on SDG 16: Peace and Justice https://www.youtube.com/watch?v=4NbU2ER-ylU accessed on 20 January 2023 https://www.youtube.com/watch?v=i5aPYAUJq_4 accessed on 20 January 2023
	SDG 17: Partnerships for the goals	**Cognitive learning objective:** Students explain the concepts of global partnerships and global citizenship.	**Socio-emotional learning objective:** Students communicate their own role and responsibilities for partnerships for the goals.	**Behavioral learning objective** Students propose suggestions for global partnerships for achieving sustainable development goals.
		Background **Videos:** Understand SDG 17 https://www.youtube.com/watch?v=4uThM0pgjB0 accessed on 20 January 2023 https://www.youtube.com/watch?v=jcfoWx14lv0 accessed on 2 February 2023	**Classroom activity:** Heroes for Change: Global citizens—Working together to achieve sustainable development goals.	**Classroom activity:** What can you do in terms of partnerships for the goals? **Videos:** Take Action on SDG 17: Partnerships for the Goals https://www.youtube.com/watch?v=Fjxzr4S51gg accessed on 20 January2023 https://www.youtube.com/watch?v=73_A-xQKLbc accessed on 20 January 2023

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