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Science Teachers' view on Sustainable Development in COVID-19 Pandemic Process

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ABSTRACT This study examines what science teachers think about Sustainable Development and its' Goals, how they integrate SDGs into their science lessons, and how the covid-19 pandemic affects their thoughts about Sustainable Development. The study group was selected by convenience sampling from 51 middle schools in the central district of one of the big cities. The questionnaire, including five open-ended questions, was prepared and checked by two experts. After their feedback, it was re-corrected and then applied to the participants. It was conducted using the "Google Forms" application. Then, it was delivered to 165 teachers' e-mail accounts. Answering the questionnaire takes approximately 10-15 minutes for each participant. One hundred five teachers answered the questionnaire. The content analysis method was used to analyze data. The results showed that teachers mainly described Sustainable Development with the goal of "Responsible Consumption and Production", "Decent Work and Economic Growth", and "Quality Education". Half of the teachers are still trying to integrate SD using traditional science subjects strategies. And generally focused on science subjects of matter cycles, environmental problems, biodiversity, fuels, and domestic waste and recycling. In this process, their problems are usually intense curriculum, insufficient time, and attitudes of school administration.

Keywords Sustainable Development Goals, Education for Sustainable Development, Primary science teachers

1. INTRODUCTION

One of the main focal points of the 21st century understanding of education is the concept of Sustainable Development. It is hard to define because of its continuous evolution. Briefly, we can determine that Sustainable Development (SD) means to develop the needs of the present without harming the next generations. This perspective emerged with the concept of Environmental Education in the 1970s. According to United Nations (UN), "SD has been recognized as an overarching goal for institutions at the national, regional and international levels since 1972" (Yiu & Saner, 2014). In the Intergovernmental Conference on Environmental Education in 1977, scientists declared that Environmental Education should enable students, who will become citizens of the future worlds, to acquire awareness, knowledge, skills, and participation in environmental issues that concern society (UNESCO, 1978). The framework of Environmental Education contained conservation and pollution issues in the '70s, then slowly broadened with the public's concerns about land-use management, population rate, energy, and production. Today, SD, climate change, and biodiversity concepts arose in Environmental Education (Hungerford, 2009). In the United Nations Conference on Environmental and Development (1992), it was reported that SD has three mutually reinforcing dimensions, social, economic, and environmental, to handle issues for supplying natural resources for next generations all over the world (Albareda-Tiana, Vidal-Raméntol, & Fernández-Morilla, 2018; Sachs et al., 2019). Societies' living standards and living conditions determine their consumerism and production trends. If we increase the welfare of their societies, we can draw people's attention to environmental problems more easily. United Nations Conference on Sustainable Development Rio+20 Conference (2012) paid attention to 7 areas, which were Jobs, Energy, Cities, Food, Water, Oceans, and Disasters. It declared the main aspect of Sustainable Development Goals (SDGs), which is to supply the national needs of countries worldwide. SDGs were tried to build logically on the Eight Millennium Development Goals, (1) End poverty and hunger (2) Universal education (3) Gender and equality (4) Child health (5) Maternal health (6) Combat HIV/AIDS (7)

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Environmental sustainability (8) Global partnership, designed to improve the lives of the poor people, were adopted by 189 nations in 2000 (Griggs, et al. 2014; Blanc, 2015; Leal Filho et al., 2019). Millennium Development Goals notable success until it ended in 2015. From this point of view, the SDGs conducted by United Nations Development Program went into operation in 2015 and are targeted by 2030. These 17 goals are named (1) No Poverty, (2) Zero Hanger, (3) Good Health & Well-Being, (4) Quality Education, (5) Gender Equality, (6) Clean Water & Sanitation, (7) Affordable & Clean Energy, (8) Decent Work & Economic Growth, (9) Industry, Innovation & Infrastructure, (10) Reduced Inequalities, (11) Sustainable Cities & Communities, (12) Responsible Consumption & Production, (13) Climate Action, (14) Life Below Water, (15) Life On Land, (16) Peace, Justice, & Strong Institutions, (17) Partnership For The Goals (Esquivel & Sweetman, 2016; Fleming, Wise, Hansen & Sams, 2017; Griggs, et al. 2014). The United Nations Development Program (UNDP) supports these goals by integrating 170 countries' governmental political plans and policies (United Nations Development Programme, 2016). Briefly, SD aims to represent nice, equal, and sustainable lifestyles for all living. The main terminology is "Sustainability", which essentially established three cornerstones, *Economy*, *Environment*, and *Society*, which is a way of national development. Sustainability helps people achieve their ambitions and improves their living standards by protecting their economic, social, and environmental systems (Brito, 2012; Leal Filho et al., 2019; Moyer & Hedden, 2020; Omole & Ozoji, 2014). Society members should be responsible for not harming the environment so that our kid's future is not endangered.

One of the important ways to integrate SD into their governmental policies is to educate people. The significance of SD in education lies within its vision of gaining environmental and ethical awareness, attitudes, and behavior. Moreover, it is helpful for decision-making in local/global problems and establishes connections with the dimensions under the SDGs (Davidson, 2014; Vladimirova & Blanc, 2016). In 2005, The UN General Assembly took a big step and invited all educational institutions to join the Decade of Education for Sustainable Development (DESD) (2005-2014) project to help new education perspectives for sustainability. According to DESD, integrating SD in education is the institutional responsibility. This responsibility is to reshape the curriculum and provide better teaching for current and next generations. Of course, this process will be long-lasting, and adopting a flexible and comprehensive point of view to change is necessary (Albareda-Tiana, Vidal-Raméntol, & Fernández-Morilla, 2018). One proof of why integrating SD is a long journey is Moyer & Hedden's (2020) study. They analyzed 186 countries by 9 SDGs indicators in their research. The data showed that 43 percent of countries-values had already been reached by 2015, and 53 percent of country values will be achieved by 2030. Thus, integration of sustainability in education is a complex, lengthy process and multidisciplinary approach to the environmental, development, socio-cultural issues, and demographic aspects. This approach improves the social dimension of Sustainable Development and its goals while providing innovative context in education (Rauch, 2002).

Although Turkey lacks practices in sustainable development, it is attentive to integrating economic, social, and environmental dimensions of SD at many levels of policy (Öztürk, 2018). According to Kaya, Çobanoğlu & Artvinli (2011), some of the key examples of Turkish sustainability policies, which aim to ensure economic, cultural, and social sustainable development, are the "National Environmental Strategy", prepared for 2007 - 2013 and the "Integration of SD into Sectoral Policies Project" with a large corporate domain. These new policies affected education. Environmental education-related subjects involving Sustainability and Sustainable Development concepts were implemented in related courses in National Educational Program.

With the 2013 Science Education Curriculum (3-8 Grades), Science-Technology-Society concepts, containing socio-scientific and Sustainable Development issues, included learning areas of the primary science courses to educate scientifically literate children. In 2018, the Ministry of National Education added the four objectives to the science education program. The program is concerned with environmental issues such as recycling and waste in general, the relationship between humans and nature, health care, global warming, and social awareness such as smoking cessation and organ donation, and 33 of the total 305 objectives in the program are related to SD in all the levels of the 3-8 grades level. Additionally, the "Sustainable Development" subject in 8-grade science program aims to integrate SD as one of the general objectives of Science Education programs and to develop an awareness of SD in society (Ateş, 2019).

In the literature, there are many studies about that. Lawale & Bory-Adams (2010) suggested that integrating SD into lessons provides a convenient learning environment for the four pillars of learning, *learning to know, learning to do, learning to live together, and learning to be,* which are the cornerstone of 21st-century education suggested by the 1996 Delors Report (2010). Tuncay-Yüksel, Yılmaz-Tüzün & Teksoz (2011) examined the relationship between moral reasoning patterns and environmental dilemmas. They found that pre-service teachers' thoughts were directly related to nature, and their environmental dilemmas were related to global issues, not local ones. Thus, they suggested examining environmental problems in lessons to help students develop moral reasoning patterns about environmental problems. Borg, Gericke, Höglund & Bergman (2014) states that one teacher cannot be expected

to handle all the dimensions of SD extensively. Thus, it is essential to follow an interdisciplinary approach.

Besides, the interconnected nature of SDGs allows teachers to associate science subjects across the lessons. Yücel & Özkan (2014) state science teachers think that the environment-related subjects in the curriculum are sufficient to acquire the ability to comprehend the 'Science-Technology-Society-Environment' relationship whereas insufficient to acquire an awareness of the environment. However, Simsekli (2015) examines the environmental practices, including activities and experiment sets, investigates the effect on the awareness of primary students' and found rises in their awareness level of local problems. Therefore, science teachers must apply curriculum goals to their lessons with student-centered strategies. Çobanoğlu & Türer (2015) investigated the preservice teachers' awareness of the social, economic, and environmental dimensions of SD. Their study showed that preservice science teachers have a higher awareness level for the environmental dimension of SD but lower awareness of the social dimension of SD than preservice social science teachers. Harman (2017) aimed to investigate the awareness of preservice science teachers about sustainability. Analyzed their drawings about their dreams of school, most preservice science teachers had low awareness, because they were not enough to connect the knowledge learned in the lessons with real life. Annan-Diab & Molinari (2017) showed how important to adopt an interdisciplinary approach in education for SD in their study and defined that SD-related subjects provide postgraduate MBA students to activate their previous knowledge and use knowledge from other disciplines. Andersen (2018) argues that to encourage teachers to use action-based and task-based learning for sustainable context, science textbooks should embody action-based and task-based activities, which would be efficient to overcome the problems related to material insufficiency and pedagogical deficiencies that limit teachers in lessons based on SDGs. Aytar & Özsevgenç (2019) evaluated how the interdisciplinary approach affects the 7th grade students' SD development, based on some courses. They declared that if practices are applied in science lessons for SD, students' conceptual understanding will increase, especially in biodiversity, soil pollution, hunger, renewable-nonrenewable energy sources, and recycling concepts. Wang, Li, Malik & Anwar (2021) study was related to educational technology and online education with the middle school learners. They gained positive attitudes and satisfaction with online education. This result can be easily implied that when we improved the learner satisfaction and increased the implementation of online education in our countries, we could achieve SDG4 (Quality Education).

People faced the COVID-19 pandemic at the beginning of 2020. This pandemic affected health, economy, society, and education significantly. The most important known effects were curfews and the closures of factories, institutions, and schools to avoid spreading the virus. At that time, closing the schools was a big step in fighting the covid pandemic for education. The closure of schools led governments to quickly change education perspectives from face-to-face teaching to the use of online teaching. The idea/practice of conducting the science lessons with direct face-to-face student participation to teach science content effectively changed within that process. All teachers had to make the rapid transition to distance learning and online teaching in a short time. Unfortunately, the teaching of SD topics in science lessons was influenced by the pandemic process. Because SD education is a transdisciplinary process that addresses the cognitive, affective, and psychomotor domains, it can be difficult for teachers in the distance education process during the pandemic process. Although it is crucial to gain knowledge, awareness, interest, and attitude toward Sustainable Development Goals for students, we do not have enough information about how our teachers handled this problem and how students are affected in that learning process.

This study aims to analyze what science teachers think about SD, how they integrate SDGs into their science lessons, and how the covid-19 pandemic process affects their thought about SD.

2. METHOD

2.1. The Research Design

A qualitative research methodology was used in this study. The research aimed to discover what Science teachers do for students to gain knowledge, awareness, interest, and attitude towards Sustainable Development Goals in 5-8 grades' Science lessons, which course subjects they do, and which techniques they use. Moreover, what limitations do they face when integrating Sustainable Development Goals in their science lessons?

2.2. Study Group

The sample in this research comprised 105 Science Teachers lecturing in 5-8 grades through convenience sampling. The convenience samples consist of participants that are easy to access thus, non-random, with % a 41.6 average response rate (Yu & Cooper, 1983). In this study, the average response rate was 63.6%. Thus, we assumed that the sample reflects the population and that the sample responds to the questions sincerely and correctly.

2.3. Data collection tools

Data collection is provided by an online questionnaire of 5 open-ended questions applied to the participants. The researcher prepared questions the asked to analyze by three expert opinions. According to their feedback, questions were revised and finalized to be applied to the study.

2.4. Data analysis

The content analysis method was applied to evaluate the teachers' responses by categorizing the study's theme and code system. The fundamental process in the content

analysis method is to categorize the collected data within the framework of certain themes, organize it into similar codes, and interpret these themes and codes to understand readers (Selçuk, Palanci, Kandemir & Dündar, 2014). The teacher responses to 5 questions were analyzed particularly, with simultaneous coding of 2 experts in Science Education.

3. RESULT AND DISCUSSION

The data are analyzed for each question separately. The participants asked the first question, "What does Sustainable Development mean?". Responses to the first questions were examined in the light of SDGs. The ninety-two (87.6%), eighty-eight (83.3%), eighty (76.2%), and seventy-nine (75.2%) of those 105 science teachers point out "Good health & Well-being," "Responsible Consumption & Production," "Decent Work & Economic Growth" and "Quality Education" goals which are the highest frequencies.

Twenty-eight (26.7 %) and thirty-five (33.3%) of 105 science teachers' responses, "Peace, Justice & Strong Institutions" and "Life Below Water," were the lowest frequencies. On the other hand, four science teachers (3.8%) responses could not be paired with SDGs (Table 1).

Table 1. Definition of SD

SDGs	f	(%)
3. Good Health & well-being	92	87.6
12. Responsible Consumption & Production	88	83.8
8. Decent Work & Economic Growth	80	76.2
4. Quality Education	79	75.2
10. Reduced Inequality	69	65.7
2. Zero Hunger	68	64.8
5. Gender Equality	60	57.1
13. Climate Action	56	53.3
7. Affordable & Clean Energy	54	51.4
6. Clean Water & Sanitation	53	50.5
9. Industry, Innovation, & Infrastructure	53	50.5
1. No Poverty	49	46.7
17. Partnerships to achieve the Goal	49	46.7
15. Life on Land	46	43.8
11. Sustainable Cities & Communities	42	40.0
14. Life Below Water	35	33.3
16. Peace, Justice, & Strong Institutions	28	26.7
None	4	3.8

The second question was, "*What do you do for students to gain knowledge, awareness, interest, or attitude towards SDGs in your lessons?*" After the content analysis of answers based on teaching/learning strategy, their responses were analyzed into three themes, "Expository Teaching" (68.6%) and "Inquiry-based Learning" (31.4%). In the expository teaching theme, science teachers generally prefer to use "direct lecturing" (42.9%), "exemplifying" (33.3%), "informing" (23.8%), "demonstration" (19.1%), and "field trip after lecturing" (9.5%) techniques in their lessons. The Inquiry-Based Learning / Hands-on theme includes 18 codes. While the highest ratio of code is the "5E" teaching model (19.1%), "project" (19.1%), and "discussion" (17.1%), the lowest ratio of code is "Philips 66" (1.9%). The exciting result was that there are many codes were detected. Thus, almost one-third of participants were still trying to use modern teaching/learning approaches, but the rest still used a traditional perspective on science teaching. Table 2 shows teaching strategies of teachers to integrate SDGs into lessons

Table 2. Teaching strategies of teachers to integrate SDGs into lessons

Theme	Code	f	%
Expository teaching (f: 72, 68.6%)	Lecturing	45	42.9
	Exemplifying	35	33.3
	Informing	25	23.8
	Demonstration	20	19.1
	After lecturing, Virtual Field Trips	10	9.5
Inquiry-Based Learning / Hands-on (f: 33, 31.4%)	5E	20	19.1
	Projects	20	19.1
	Discussions	18	17.1
	Open-ended Questions	12	11.4
	Open-lab approaches	12	11.4
	Brainstorming	9	8.6
	Argumentation	5	4.8
	Narrative (problem-based scenario)	5	4.8
	Student Tasks (presentation)	5	4.8
	Compare & Contrast Examples	4	3.8
	6 thinking hat	4	3.8
	before lecturing, the Field trip	4	3.8
	Concept cartoon	3	2.9
	Flip-flop	3	2.9
	Research Studies	3	2.9
	Using Visual- Technological tools	3	2.9
	Philips 66	2	1.9

The third question, "*In what science subjects do you connect with SDGs in your lessons?"* was designed to discover science subjects teachers associate with SDGs in their lessons. The answers were categorized into three units of science area. "In the Earth and Universe" unit, there were found 13 science subjects. The highest ratio was "Matter Cycles and Environmental Problems" (13.5%), "Sustainable Development" (11.8%), and "Biodiversity" (9.6%). The lowest rates were "Reproduction, Growth, & Development in Human" (1.3%) and "Reproduction, Growth, & Development in Plants & Animals" (1.3%). "In the Matter and Its Nature" unit, four science subjects were found. While the highest ratio was "Fuels" (10.6%) and "Domestic Wastes and Recycling" (9.6%), the lowest rate was "Acids and Bases" (0.9%). The only science subject,

Table 3. SDGs related science subjects areas

Science Subjects		*f*	%
The Earth and Universe unit			
5 grade	Biodiversity	30	9.6
	Human-Environment Relationship	24	7.7
	Destructive Natural Events	10	3.2
6 grade	Systems and Health in Our Body	7	2.2
7 grade	Reproduction, Growth, & Development in Human	4	1.3
	Reproduction, Growth, & Development in Plants and Animals	4	1.3
8 grade	Matter Cycles & Environmental Problems	42	13.5
	Sustainable Development	37	11.8
	Biotechnology	22	7.1
	Food Chain and Energy Flow	17	5.5
	Energy Conversions	10	3.2
	Climate & Air Movements	7	2.2
	DNA & Genetic Code	4	1.3
Matter and Its Nature unit			
6 grade	Fuels	33	10.6
7 grade	Domestic Wastes & Recycling	30	9.6
8 grade	Chemical Industry in Turkey	10	3.2
	Acids and Bases	3	0.9
Physical Events unit			
8 grade	Transformation of Electrical Energy	18	5.8
TOTAL		312	100.0%

"Transformation of Electrical Energy" (5.8%) in the "Physical Events" unit, was said by participants (Table 3).

The fourth question, *"What are the reasons that limit your studies on SDGs in your lessons?"* was asked , and participants' answers were analyzed. The results showed that 14 codes appeared as limitations when science teachers connect with science subjects and SDGs in their lessons. According to 105 science teachers, the high limitations for teachers were "insufficient time" (57.1%), "intense curriculum" (55.2.1%), and "exam-based education system" (52.8%). Additionally, teachers mentioned educational policy, school physical situations, technological deficiencies, families' perspectives, students' knowledge levels, and pedagogical deficiencies as their limits. The lowest limit declared by science teachers was "science has abstract knowledge" (9.5%), and only two science teachers declared they had not faced obstacles because they said, "I do not do anything related to SDGs." Table 4 discusses reasons that limit teachers from making connections with SDGs in their lessons.

The last question of the study was, *"Could you explain how the coronavirus (COVID-19) pandemic has affected your thoughts about teaching SD?* The 105 participants' answers were separated into two categories, positive and negative thoughts. The teaching of SD in science lessons was generally affected negative way. Teachers' negative thoughts were analyzed in 3 themes, teachers, students, and administrators. According to teachers, they were caught unprepared during the covid process because they didn't

Table 4. Reasons that limit teachers to make connections with SDGs in their lessons

Limitations	*f*	%
Insufficient time	60	57.1
Intense curriculum	58	55.2
Exam based educational system	55	52.8
Informal learning environment constraints	40	38.1
Economic reasons / financial resources	35	33.3
Crowded population	35	33.3
Pedagogical deficiencies	34	32.4
Student disinterest	28	26.7
Student's knowledge level	25	23.8
Attitudes of parents/families	20	19
Attitudes of school administration	18	17.1
Physical deficiency in school	18	17.1
Science is abstract	10	9.5
None	2	1.9

have enough knowledge about pedagogical teaching models for distance learning (83.8%), online teaching experience (80.9%), about time to make the transition (76.2%), and about the evaluation of student's performance (66.7%). Moreover, they have technological device problems, internet access problems (49.5%), and computer problems (47.6%). They also do not know how to use new technological devices (47.6%) and do not have enough experience with virtual field trips (47.6%) and virtual lab experiences (43.8%). Furthermore, about one-quarter of the participants said they lacked personal

Table 5. The COVID-19 pandemic effects of SD teaching

Thoughts	Source of problem	Codes	f	%
Negative	Teachers	Lack of pedagogical knowledge of distance learning	88	83.8
		Lack of online teaching experience	85	80.9
		The limited time to make the transition,	80	76.2
		Evaluation of students' performance	70	66.7
		Internet access problems	52	49.5
		Computer problems	50	47.6
		Lack of expertise regarding new technologies	50	47.6
		Lack of virtual field trips experience	50	47.6
		Lack of virtual labs experience	46	43.8
		Lack of materials/resources	45	42.8
		Lack of personal interactions/dialogues with colleagues	28	26.7
		Lack of personal interactions/dialogues with students	24	22.9
	Students	Computer problems	70	66.7
		Internet access problems	68	64.8
		Lack of interest/motivation	45	42.8
	Administrator	Lack of support from the administration	40	38.1
Positive	Human beings let nature breathe (ex. Reducing carbon emission, global warming …)		75	71.4
	Understanding of some SDGs	SDG3 (Health & Well-Being),	97	92.9
		SDG4 (Quality Education),	70	66.7
		SDG8 (Decent Work & Economic Growth),	55	52.9
		SDG12 (Consumption & Production)	54	51.4
	Government effort	Education quality (technology integration)	35	33.3
		Equal education	28	26.7

interaction/dialogue with colleagues (26.7%) and students (22.9%). In the student's theme, there were seen internet access problems (66.7%), computer problems (64.8%), and lack of interest/motivation (42.8%). Forty teachers (38.1%) thought they did not have enough support from the administration.

Given positive thoughts by teachers are generally future perceptions of education. They thought that people let nature breathe (ex. reducing carbon emission, global warming) (71.4%) and understood how the importance of some SDGs, which are SDG3 (Health & Well-Being) (92.9%); SDG4 (Quality Education) (66.7%); SDG8 (Decent Work & Economic Growth) (52.9%); and SDG12 (Consumption & Production) (51.4%). Additionally, politics understood and made some efforts in Education quality (especially technology integration) (33.3%) and equality in education (26.7%). Table 5 tabulates the COVID-19 pandemic effects of SD teaching

According to Quality Assurance Agency in the UK, the main aim of education of SD is to raise knowledgeable and skilled students who can contribute to the development of humanity and, for that purpose, guard the environmental, social, and economic well-being, both in the present and for next generations (Kemp, Bellingham & Longhurst, 2014). Science teachers know this purpose. Their thoughts generally focused on Good Health & Well-being (SDG3), Responsible Consumption & Production (SDG12), Decent Work & Economic Growth (SDG8), and Quality Education (SDG4). This result has similarities with Shulla et al., (2021) analyzing how the covid19 pandemic affected the SDGs. They defined a model of the state of being connected with SDG3 (Health & Well-Being), SDG4 (Quality Education), SDG8 (Decent Work & Economic Growth), SDG12 (Consumption & Production), SDG13 (Climate Action), and COVID-19 consequences. Moreover, this study highlighted social and economic than environmental dimensions because of the Covid-19 pandemic process. The restriction of people's social life, quarantines, and other occupational groups having to close businesses may be the reasons for their thoughts.

While one-third of the teachers still used modern science teaching methods to teach SD in their lessons, the remaining participants were using conservative methods because they probably did not know contemporary teaching methods. Although the transition began from a conservative teaching perspective to a student-centered teaching perspective in 2005, they still have a problem with to use of techniques and methods of the student-centered approach. According to the Ministry of National Education Board, "The science curriculum in Turkey, have general goals that needed to implement that all students be able to "use science process skills and scientific research designs to produce solutions for human-environment related issues" (goal 2), and "to develop reasoning patterns, scientific thinking habits, and decision-making skills by using socio-scientific issues" (goal 9) (p.9). Unfortunately, two-thirds

of teachers mainly use conservative teaching methods (lecturing, informing), which scarcely gives opportunity to students to gain these goals. On the other hand, the 5E teaching model, projects, and discussion techniques were mostly preferred, rarely preferred Philips 66, visual technological tools, research studies, and flip-flops to apply by science teachers.

The findings of this study reveal those science teachers consider teaching environment-related SDGs more than social-related SDGs. Because they focused generally on the unit of The Earth and Universe. The high subjects, biodiversity, matter cycle, environmental problems, fuels, domestic wastes, and recycling, are remembered chiefly in their science lessons. Çobanoğlu & Türer (2015) found the same results in their study of science teacher candidates. As science teachers have environment lessons in higher education and their teaching area includes environmental science, awareness of SD in the ecological dimension is assumed to be higher than in other dimensions. Therefore, they attribute mostly environmental SDGs to define SD. The science teaching program in Turkey is a spiral curriculum with repetitive objectives and explanations in different subjects and grade levels, besides holistic outcomes. This spiral approach enables teachers to create a multidisciplinary lesson context in which students use their prior knowledge from science and all other related courses. In Agenda21, interconnections between socio-cultural aspects of the environment and development issues are suggested through multidisciplinary curricula (UNCED, 1992). However, Jimenez, Lerch & Bromley (2017) reviewed over 1000 books worldwide, and findings reveal that not all issues at the global level that are compatible with SDGs are evenly included in the school curriculum. For instance, violence against women and LGBT rights still seems too delicate for school discussions. Likewise, although science contexts are convenient for the SDGs like Gender Equality and Reducing Inequalities, explicitly related subjects and objectives couldn't find in the 2018 science curriculum in Turkey, but the linkages that teachers' emphasis or guidance on implicitly related subjects. The lack of integrated and multidisciplinary structure is also found in UN reports as there are poor connections between education and energy, water, urbanization, and a lack of policy implications dimensions (Vladimirova & Blanc, 2016). Thus, in general, reports and policies, education should have a better place for educational system developers and educators to devote themselves to integrating SDGs into learning environments.

According to results of limitations of implementing SD in science lessons findings, insufficient time, intense curriculum, and the exam-based education system are the most significant limitations for science teachers in integrating SDGs into their course subjects. Özsevgeç & Artun (2005) also define some related difficulties, such as teachers' inadequate time for environmental subjects and deficiency of objectives. Their study examines teachers' challenges in the "Human and Environment" unit. To overcome these problems, SDGs and environment-related subjects can place in the other subjects by taking advantage of their multidisciplinary and multidimensional characteristics. The teacher, who states that s/he didn't do anything related to SDGs because of the exam-based educational system and attitudes of school administration, parents, and students regard to environment-related subjects, defines crucial problems in environmental education. Although one of the goals of the Science curriculum in Turkey is to enable students "To recognize the interaction between the individual, environment, and society; develop an awareness of SD in society, economy, and natural resources." The aim of science education may correlate to people's knowledge of science content (Smith & Siegel, 2004). Thus, it is vital to people understand that to resolve environmental crises, raise individuals who are aware of the environmental consequences of their actions, determine their behaviors accordingly, and act on the issues by examining the environmental aspects of state and private sector policies through environmental education (Teixeira, 2013).

Almost half of the participants declared they did not know how to use virtual labs, virtual field trips, and new technological software. One-fourth of participants have struggled with interactions/dialogues with students and colleagues. Moreover, all students must have a computer, tablet, or cell phone to join online lessons. This fact is the barrier to an equal education. Because science teachers defined that students have computers, internet access, and motivational problems. The government should consider getting higher education quality and equal education standards for the pandemic effects. This result parallels Dovletmurzaeva, Magomadova & Barzaeva (2021), which invited the governments to solve the problem by creating additional organizations and financial support to afford the pandemic process's effect on SDG 4.

4. CONCLUSION

The COVID-19 pandemic influenced the whole education system, of course, the integration of SD in science teaching. Unfortunately, there was not enough time to adapt the requirements of the solution to the pandemic problem for education. Many countries found the solution via applying distance/online learning strategies. However, science teachers who participated in this study mostly do not have enough knowledge about pedagogical teaching models for distance learning, do not have enough experience in online teaching, and do not know how to evaluate their students on online lessons besides using new technological devices and internet access problems. As known, the best way of teaching SDGs is to use student-centered teaching approaches/strategies, but this

perspective has been halted or postponed by teachers and circumstances.

Conversely, the pandemic process has had a positive impact on the understanding of some SDGs. Science teachers think that human beings let nature breathe and renew itself. All people understand how health and well-being, power of economics, and quality of education are important for people to leave a nice world to the next generation. The governments should make big steps to reach higher education quality and equal education standards for their students.

The conclusion of this study is that science teacher should carefully analyze curriculum based on objectives and main goals of science education and apply them to their lessons by considering students' active involvement ensuring analyzing, researching, reasoning, and scientific thinking. This way, we can achieve the next generation's effective public participation in SD and reach the SDGs. Besides, government effort is necessary to afford technological devices and internet access for all students

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