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Comparative Analysis of Turkey and Germany (Bavaria) Secondary Education Curricula in Terms of Education for Sustainable Development

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Abstract

Education for Sustainable Development (ESD) is a teaching and learning approach that is based on the principles that underpin sustainability and applies to all levels of education. However, there is a scarcity of research on the integration of curricula with ESD. In this study, secondary school curricula in Germany (Bavaria) (geography, nature and technology) and secondary school curricula in Turkey (social studies, sciences) were compared in terms of learning outcomes and learning areas to the principles of sustainable development (social-environmental-economic). Attempts have been made to shed light on how ESD is reflected in the curricula of Turkey and Germany, as well as how the approach of ESD directs the education curricula. According to the findings of the study, the learning outcomes and learning areas of the curricula of Turkey and Germany are related to the principles of sustainable development, and learning outcomes related to SD dimensions are given more place in the upper grades. Turkey's social studies curriculum is more related to SD's social dimension principles; the science curriculum is more related to SD's environmental dimension principles; and Germany's geography, nature and technology curricula are more related to SD's environmental dimension principles. The number of learning outcomes related to the economic dimension principles of SD in both countries' curricula has been determined to be very low. Especially in Germany's curricula, unlike Turkey's curricula, it has been determined that students offer solutions to existing environmental-social-economic problems for sustainability in the context of problem-solving skills and learning outcomes that include case study activities are included.

Key words: education for sustainable development, comparative education, Turkey and Germany Curricula, sustainable development, dimensions of sustainable development

Introduction

Sustainability is an effort to put in place standards and expectations for vital activities. It is a focal point for irregularities and injustices in environmental/nature-oriented action and consumption habits of societies that are becoming more complex by the day. Material production and consumption processes in societies are both social and environmental. Sustainability is sensitive to the environment/nature, focused on social justice,

and has a supra-disciplinary feature. It is the description of the effort that prioritizes a life in which all living beings are equal and takes into account the expectations for the future and becoming collective (Özgen, 2019). The concept of sustainability began to gain importance in the 1980s. SD was defined in the UN World Commission on Environment and Development's 1987 Brundtland report "Our Common Future" as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Tanrıverdi, 2009). SD is a path toward achieving what is good and desirable in society. For this reason, the concept of SD has become very comprehensive and complex (Holden et al., 2014; Ilisko et al., 2021).

SD is classified with principles in the triangle of society, economy, and environment (Gedik, 2020; Heasley et al., 2021). Table 1 shows the fundamental principles associated with each dimension:

Table 1

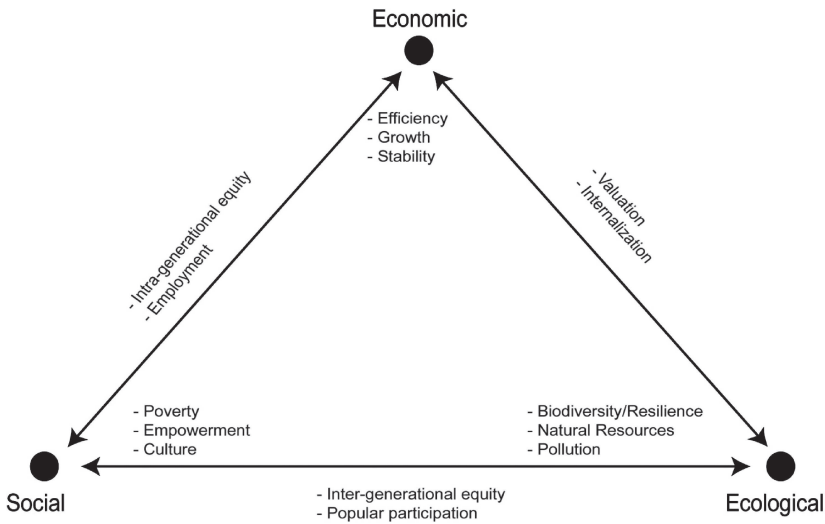
Dimensional Principles of Sustainable Development

Dimensional principles of sustainable development	Social	<ul style="list-style-type: none"> • Equal access to key services • Generational equity • A relationship system that values different cultures • Political participation of citizens, particularly at the local level • A sense of community • A system for communicating social sustainability awareness • Mechanisms that enable a society to meet its own needs whenever possible • Political advocacy to meet needs that cannot be met through community action (Mckenzie, 2004, p. 12; Morelli, 2011, p. 3).
	Environmental	<ul style="list-style-type: none"> • Protecting the integrity of ecosystems through efficient management of natural resources • Improving information for decision making (measuring progress through indicators) • Social and environmental interface (improving quality of life) • Global environmental commitment (improving governance and collaboration) • Giving importance to recycling • Preventing the release of dangerous and polluting substances into the environment • Effective use of non-renewable resources (must be replaced with renewable resources) • Long-term perspective (without any set time limit) • Taking into account the feedback • Giving importance to different scales (in terms of time and place) • Flexibility (adaptation to change, learning-by-doing) • Care for nature and biodiversity (Moldan et al., 2012, p. 6).
	Economic	<ul style="list-style-type: none"> • Financial performance of corporations • How corporations handle fixed assets • The impact of corporations on the economy • Social and environmental impacts of corporations and how they manage them (Doane & MacGillivray, 2001).

Dimensions and principles that are integrated into a unity are inextricably linked. Accordingly, the relationship between the principles in Table 1 and the dimensions of sustainability is given in Figure 1:

Figure 1

Graphical Representation of Sustainable Development (Munasinghe 1993 as cited in Ruggerio, 2021)



As indicated in Figure 1, the principles of SD are shaped in the triangle of society, environment, and economy. In this context, the social, environmental and economic sustainability dimensions should be reflected in education programmes in an integrated manner (UNESCO, 2017b). Due to the social, environmental and economic problems in the century we live in, the concept of sustainability has been on the agenda of many countries and has become a global common policy. Recently, ESD has been used to solve the problems experienced in these areas (Korkmaz, 2020). Studies have been carried out in many different fields and many studies have been conducted in the field of education related to SD, which is especially important for our future. When the literature is examined, theoretical studies on ESD (Bilgili, 2017; Harris, 2000; Holden et al., 2014; Kılıç, 2012; Kopnina & Meijers, 2014; Pawłowski, 2008; Redclift, 1991; Wu & Shen, 2016), knowledge-awareness-attitude studies on SD (Berglund & Gericke, 2016; Gustafsson et al., 2015; Michalos et al., 2011; Summers & Childs, 2007), studies on a country basis (Bormann & Nickel, 2017; Dambudzo, 2015; Jóhannesson, 2011; McGarr, 2010; McNaughton, 2007; McNaughton, 2012; Mohanty & Dash, 2018; Muijen, 2004; Yuan & Zuo, 2013), comparative country studies (Brunold, 2015; Iliško et al., 2017; Kerscher, 2019; Roofoe & Ferguson, 2018; Sahin, 2016; Svalfors, 2017; Zguir et al., 2021), examinations on the basis of course-curriculum (Ateş, 2019; Bulut & Çakmak, 2018; Hacat & Demir, 2019; Haque, 2013; Ifegbesan et al., 2017; López, 2022; Yalçınkaya, 2013), reports (UN, 2021; UNESCO, 2006; UNESCO, 2014), and teacher-prospective teacher training (Kalsoom & Qureshi, 2019; Shallcross & Robinson, 2007; UNESCO, 2017a) have been carried out.

Despite studies on ESD being conducted in Turkey and Germany, no study has been found that compares the current situation in the context of the courses. The German National ESD Platform adopted an action plan in 2017 that aims to reflect ESD at all levels of the German education system, which is why Germany's Bavarian state curricula were chosen as the scope of the study. In addition, ESD is included as a theme in the German (Bavaria) curriculum. Furthermore, the state of Bavaria has the highest PISA score in Germany. In Turkey, the importance of ESD was emphasized in the SD report prepared by the Turkish Ministry of Development in 2012, with the curriculum to be developed aiming to raise awareness of the next generations. Besides, ESD has been mentioned at the level of awareness in the special objectives of Turkey's science and social studies curriculum.

In this regard, it is considered that this research will be useful. This study aims to reveal the current situation in both countries in terms of courses and reveal what needs to be developed and improved by drawing attention to the importance of ESD. Based on this, it is intended to compare and contrast Turkish and German curricula within the context of ESD. In order to achieve this goal, the curricula of the four closest courses (social studies, science-geography, nature and technology) related to SD in Turkey and Germany were compared to SD principles (social-environmental-economic), in terms of learning outcomes and areas.

The purpose of this study is to compare the learning outcomes and learning areas of the curricula of Turkey and Germany (Bavaria) in the context of ESD. The comparison was made using the dimensional (social, environmental, economic) principles of SD established by Doane and MacGillivray (2001), McKenzie (2004), Moldan (2012), Morelli (2011). The research questions are presented below:

1. How is the distribution learning outcomes and learning areas of social studies curriculum in Turkey based on the three dimensions of SD (social, environmental, and economic)?
2. How is the distribution learning outcomes and learning areas of science curriculum in Turkey based on the three dimensions of SD (social, environmental, and economic)?
3. How is the distribution learning outcomes and learning areas of geography curriculum in Germany (Bavaria) based on the three dimensions of SD (social, environmental, and economic)?
4. How is the distribution of learning outcomes and learning areas nature-technology curriculum in Germany (Bavaria) based on the three dimensions of SD (social, environmental, and economic)?

Method

Research Design

The data from this qualitative study were analyzed using the document analysis method in accordance with the horizontal-descriptive approach of Comparative Education. According to Yildirim and Simsek (2013), "Document analysis includes the analysis of written materials containing information about the phenomenon or phenomena that are to be investigated. Document analysis can be used as a stand-alone method or in

conjunction with other data collection methods.” In the research, learning outcomes of social studies (5th, 6th, and 7th grades), science (5th, 6th, 7th, and 8th grades) in Turkey’s secondary school and learning outcomes of geography (5th and 7th grades), nature and technology (6th, 7th, and 8th grades) in Germany’s secondary school (Gymnasium) were interpreted by comparing them with SD principles (social-economic-environmental). In addition, the learning areas of social studies and science curricula in Turkey and learning areas of geography, nature and technology curricula in Germany (Bavaria-Gymnasium) were compared with the principles of SD (social-economic-environmental). The research is limited to the “2018 Turkey secondary school curricula” and “2021 Germany’s (Bavaria) secondary school (Gymnasium) curricula”.

Scope of the Research

Curricula of social studies and science (Turkey) as well as curricula of geography and nature-technology (Germany-Bavaria) were examined as they are more related to SD than other curricula.

Data Collection and Analysis

The research data consists of the principles of SD (social-environmental-economic), the 2018 secondary school curriculum (social studies, sciences) in Turkey, and the 2021 secondary school (Gymnasium) curriculum (geography, nature and technology) in Germany (state of Bavaria) that are analysed according to these principles. In terms of learning outcomes and learning areas, the curricula examined were compared to the principles of SD (social-environmental-economic). The data analyzed in the study are given in Table 2.

Table 2

Data of the Research

Country	Curricula	Grade level	Category
Turkey	Social Studies	5–6–7	Learning Outcome-
	Science	5–6–7–8	
Germany (Bavaria)	Geography	5–7	Learning Area
	Nature and Technology	6–7–8	

Research Findings

The research findings were presented in accordance with the research questions.

Findings Regarding the First Research Question

The study’s first research question is, “How is the distribution learning outcomes and learning areas of social studies curriculum in Turkey based on the three dimensions of SD (social, environmental, and economic)” and that analysed according to grade levels.

The Relationship Between Learning Outcomes of Social Studies and SD Dimensions

Learning outcomes and learning areas of social studies and science were examined by associating them with the three dimensions of SD (social-economic-environmental). Learning outcomes of social studies are compared with the dimensions of SD at the grade level, and the results are given in Table 3.

Table 3

The Relationship Between Learning Outcomes of Social Studies and SD Dimensions

Grade	The total number of learning outcomes	The number of learning outcomes associated with SD	SD Dimension	The number of SD learning outcomes
5	33	10	Social	4
			Environmental	3
			Economic	3
6	34	9	Social	6
			Environmental	2
			Economic	1
7	31	10	Social	5
			Environmental	6
			Economic	2

When the data in Table 3 is examined, it is possible to conclude that the number of learning outcomes associated with the dimensions of SD is similar at the 5th, 6th and 7th-grade levels of the social studies. In particular, it is seen that the number of learning outcomes associated with the social dimension of SD is greater than the other dimensions. The number of learning outcomes associated with the social dimension of SD is 15, the environmental dimension of SD is 8 and the economic dimension of SD is 6. Learning outcomes of social studies associated with social dimension principles of SD are given in Table 4.

Table 4

The Relationship Between Learning Outcomes of Social Studies and Social Principles of SD

Learning outcome	Social principles of SD
SS.5.1.3. As individuals who are aware of their rights, they act in accordance with the duties and responsibilities imposed by the roles they play in the organisations in which they participate.	A sense of community
SS.5.2.3. By comparing the cultural characteristics of various parts of our country with the cultural characteristics of the environment they live in, they identify the similar and different elements between them.	A relationship system that values different cultures
SS.5.2.4. They analyse the role of cultural elements in the coexistence of people.	Generational equity

See next page for continuation of table

Continuation of Table 4

SS.5.4.1. They discuss the effects of technology use on socialisation and social relations.	A system for communicating social sustainability awareness
SS.6.1.1. They examine the change of social roles over time.	Generational equity
SS.6.1.2. They analyse the place and role of social, cultural, and historical ties in the formation of social cohesion.	A sense of community
SS.6.1.3. They examine prejudices about differences in order to live in harmony in society.	A relationship system that values different cultures
SS.6.1.4. They participate in activities that support social assistance and solidarity as a means of fostering social unity.	A sense of community
SS.6.7.1. They analyse our country's cultural, social, political, and economic ties with the Turkic Republics and neighbouring states.	A relationship system that values different cultures
SS.6.7.3. They analyse our country's international roles depending on its political, military, economic, and cultural characteristics.	A sense of community
SS.7.1.2. They use positive communication methods in their individual and social relations.	A sense of community
SS.7.1.4. Using their rights and fulfilling their responsibilities, they make use of communication tools.	Equal access to key services
SS.7.5.3. They give examples of the work of institutions and non-governmental organisations and their roles in social life.	Political advocacy to meet needs that cannot be met through community action.
SS.7.7.2. They recognise economic regions and institutions with which Turkey has relations.	A sense of community
SS.7.7.3. They examine various cultural stereotypes.	A relationship system that values different cultures

According to the data in Table 4, it is seen that the majority of social studies learning outcomes associated with social dimension of SD are “a sense of community” and “a relationship system that values different cultures,” which are two of the principles that comprise the social dimension. Learning outcomes of social studies associated with environmental dimension principles of SD are given in Table 5.

Table 5*The Relationship Between Learning Outcomes of Social Studies and Environmental Principles of SD*

Learning outcome	Environmental principles of SD
SS.5.1.2. They explain the multidimensionality of an event by using an example from their immediate surroundings.	Giving importance to different scales (in terms of time and place)
SS.5.3.4. They question the causes of disasters and environmental problems in the environment they live in.	Taking into account the feedback
SS.5.3.5. They explain the effects of natural disasters on social life with examples.	Global environmental commitment (improving governance and collaboration)

See next page for continuation of table

Continuation of Table 5

SS.6.4.2. They propose ideas about the effects of scientific and technological developments on the future of life.	Long-term perspective (without any set time limit)
SS.6.5.2. They analyse the effects of overconsumption of resources on life on earth.	Care for nature and biodiversity
SS.7.3.1. Through case studies, they draw conclusions about the factors influencing settlements from the past to the present.	Giving importance to different scales (in terms of time and place)
SS.7.5.1. They explain the importance of soil in production and management with examples from the past and present.	Giving importance to different scales (in terms of time and place)
SS.7.7.4. They develop ideas and suggestions for the solution of global problems with their friends.	Protecting ecosystem integrity through effective natural resource management

According to the data in Table 5, it is seen that the majority of social studies learning outcomes associated with environmental dimension of SD are “Giving importance to different scales (in terms of time and place),” which is one of the environmental dimension’s principles. Learning outcomes of social studies associated with economic dimension principles of SD are given in Table 6.

Table 6*The Relationship Between Learning Outcomes of Social Studies and Economic Principles of SD*

Learning outcome	Economic principles of SD
SS.5.5.3. They analyse the effects of economic activities in their surroundings on people’s social lives.	Social and environmental impacts of corporations and how they manage them
SS.5.5.4. They analyse the production, distribution and consumption networks of products that meet basic needs.	Social and environmental impacts of corporations and how they manage them
SS.5.5.5. They collaboratively develop new ideas based on production, distribution and consumption.	Social and environmental impacts of corporations and how they manage them
SS.6.5.1. They relate to our country’s resources and economic activities.	The impact of corporations on the economy
SS.7.5.2. They evaluate the impact of advances in manufacturing technology on social and economic life.	The impact of corporations on the economy
SS.7.5.6. They analyse the changes brought by digital technologies in production, distribution, and consumption networks.	The impact of corporations on the economy

According to the data in Table 6, it is seen that the majority of the social studies learning outcomes associated with the economic dimension of SD are “Social and environmental impacts of corporations and how they manage them” and “The impact of corporations on the economy.”

The Relationship Between Learning Areas of Social Studies and SD Dimensions

Learning areas of social studies associated with the three dimensions of SD (social-economic-environmental) are given in Table 7.

Table 7

The Relationship Between Learning Areas of Social Studies and SD Dimensions

Learning area	Grade 5			Grade 6			Grade 7					
	Learning outcome	SD-related learning outcome			Learning outcome	SD-related learning outcome			Learning outcome	SD-related learning outcome		
		Social	Environmental	Economic		Social	Environmental	Economic		Social	Environmental	Economic
Individual and Society	4	1	1	-	5	4	-	-	4	2	-	-
Cultural Heritage	5	2	-	-	5	-	-	-	5	-	-	-
People, Places and Environments	5	-	2	-	4	-	-	-	4	-	1	-
Science, Technology and Society	5	1	-	-	4	-	1	-	4	-	-	-
Production, Distribution and Consumption	6	-	-	3	6	-	1	1	6	1	1	2
Active Citizenship	4	-	-	-	6	-	-	-	4	-	-	-
Global Commitment	4	-	-	-	4	2	-	-	4	2	1	-
Total	33	4	3	3	34	6	2	1	31	5	3	2

According to the data in Table 7, it can be stated that the “Production, Distribution and Consumption” and “Individual and Society” learning areas from social studies are the ones most associated with the three dimensions of SD. It is seen that the learning area that cannot be associated with any dimension of SD, social-environmental-economic, is “Active Citizenship”.

Findings Regarding the Second Research Question

The study’s second research question is, “How is the distribution learning outcomes and learning areas of science curriculum in Turkey based on the three dimensions of SD (social, environmental, and economic)” and analysed that according to grade levels.

The Relationship Between Learning Outcomes of Science and SD Dimensions

Learning outcomes of science are compared with the dimensions of SD at the grade level, and the results are given in Table 8.

Table 8

The Relationship Between Learning Outcomes of Science and SD Dimensions

Grade	The total number of learning outcomes	The number of learning outcomes associated with SD	SD Dimension	The number of SD learning outcomes
5	36	7	Social	–
			Environmental	7
			Economic	–
6	59	2	Social	–
			Environmental	2
			Economic	–
7	67	9	Social	–
			Environmental	9
			Economic	–
8	61	11	Social	–
			Environmental	11
			Economic	–

When the data in Table 8 is examined, it can be seen that the number of learning outcomes associated with the dimensions of SD is at the 8th grade level at most and the 6th grade level at the very least. All of the associated learning outcomes can be linked to the environmental dimension of SD. Learning outcomes of science associated with environmental dimension principles of SD are given in Table 9.

Table 9

The Relationship Between Learning Outcomes of Science and Environmental Principles of SD

Learning outcome	Environmental principles of SD
S.5.6.1.1. They question the importance of biodiversity for natural life.	Care for nature and biodiversity
S.5.6.1.2. Based on research data, they discuss the factors that threaten biodiversity.	Care for nature and biodiversity
S.5.6.2.1. They express the significance of human-environment interaction.	Protecting ecosystem integrity through effective natural resource management
S.5.6.2.2. They propose solutions to environmental problems in their immediate surroundings or in our country.	Improving information for decision making (measuring progress through indicators)
S.5.6.2.3. They make inferences about environmental problems that may occur in the future as a result of human activities.	Long-term perspective (without any set time limit)
S.5.6.2.4. They use examples to discuss the benefits and drawbacks of human-environment interactions.	Taking into account the feedback
S.5.6.3.2. They express ways of protection from destructive natural events.	Flexibility (adaptation to change, learning-by-doing)

See next page for continuation of table

Continuation of Table 9

S.6.4.4.1. They classify fuels as solid, liquid, and gaseous fuels and provide examples of commonly used fuels.	Effective use of non-renewable resources (must be replaced with renewable resources)
S.6.4.4.2. They discuss the effects of the use of different types of fuels for heating on humans and the environment.	Effective use of non-renewable resources (must be replaced with renewable resources)
S.7.1.1.2. They explain the causes of space pollution and predict the possible consequences.	Long-term perspective (without any set time limit)
S.7.4.5.1. They distinguish between recyclable and non-recyclable materials in household waste.	Giving importance to recycling
S.7.4.5.2. They design a project for the recycling of household solid and liquid waste.	Giving importance to recycling
S.7.4.5.3. They question recycling in terms of resource efficiency.	Giving importance to recycling
S.7.4.5.4. They are concerned with waste management in their immediate surroundings.	Giving importance to recycling
S.7.4.5.5. They create a task to distribute their reusable items to those in need.	Giving importance to recycling
S.7.5.1.4. They provide examples of innovative solar energy applications in daily life and technology.	Effective use of non-renewable resources (must be replaced with renewable resources)
S.7.5.1.5. They discuss their thoughts on how solar energy will be used in the future.	Effective use of non-renewable resources (must be replaced with renewable resources)
S.7.5.3.3. They determine the focal points of convex and concave lenses by testing.	Preventing the release of dangerous and polluting substances into the environment
S.8.2.4.1. They explain how living creatures adapt to their surroundings by observation.	Care for nature and biodiversity
S.8.4.4.7. They provide solutions for the prevention of acid rain.	Global environmental commitment (improving governance and collaboration)
S.8.6.3.3. They discuss the causes and potential consequences of global climate change.	Long-term perspective (without any set time limit)
S.8.6.4.1. They are concerned with resource efficiency.	Protecting ecosystem integrity through effective natural resource management
S.8.6.4.2. They design projects for the efficient use of resources.	Protecting ecosystem integrity through effective natural resource management
S.8.6.4.3. They emphasise the importance of solid waste separation for recycling.	Giving importance to recycling
S.8.6.4.4. They propose solutions based on research data on recycling's economic contribution to the country.	Giving importance to recycling
S.8.6.4.5. They propose solutions by describing the problems that may arise in the future if resources are not used wisely.	Long-term perspective (without any set time limit)
S.8.7.3.4. He or she provides ideas about the benefits and drawbacks of power plants.	Preventing the release of dangerous and polluting substances into the environment

See next page for continuation of table

Continuation of Table 9

S.8.7.3.5. They discuss the significance of conscious and efficient electrical energy use in the context of the family and the country's economy.	Protecting ecosystem integrity through effective natural resource management
S.8.7.3.6. They try to use electricity wisely in the home.	Protecting ecosystem integrity through effective natural resource management

According to the data in Table 9, it is seen that most of the learning outcomes associated with the environmental dimension of SD are “to attach importance to recycling” and “protect ecosystem integrity through effective natural resource management”.

The Relationship Between Learning Areas of Science and SD Dimensions

In Table 10, learning areas of science associated with the 3 dimensions of SD (social, economic, and environmental) are given.

Table 10

The Relationship Between Learning Areas of Science and SD Dimensions

Learning area	Grade 5			Grade 6			Grade 7			Grade 8				
	Learning outcome	SD-related learning outcome		Learning outcome	SD-related learning outcome		Learning outcome	SD-related learning outcome		Learning outcome	SD-related learning outcome			
		Social	Environmental		Economic	Social		Environmental	Economic		Social	Environmental	Economic	
Earth and the Universe	7	-	-	5	-	-	10	-	1	-	3	-	-	-
Creatures and Life	9	-	7	22	-	-	15	-	-	-	25	-	7	-
Physical Events	14	-	-	19	-	-	26	-	3	-	16	-	3	-
Matter and Nature	6	-	-	13	-	2	16	-	5	-	17	-	1	-
Total	36	-	7	59	-	2	67	-	9	-	61	-	11	-

Table 10 shows that the “Creatures and Life” learning area, which is one of the science learning areas, is the one most associated with the environmental dimension of SD. It can be seen that “Earth and the Universe” is the science learning area that is least associated with the dimensions of SD.

Findings Regarding the Third Research Question

The third research question of the study, “How is the distribution learning outcomes and learning areas of geography curriculum in Germany (Bavaria) based on the three dimensions of SD (social, environmental, and economic)” and that analysed according to grade levels.

The Relationship Between Learning Outcomes of Geography and SD Dimensions

Learning outcomes and learning areas of geography and nature-technology were examined by associating them with the three dimensions of SD (social-economic-environmental). Learning outcomes of geography are compared with the dimensions of SD at the grade level, and the results are given in Table 11.

Table 11

The Relationship Between Learning Outcomes of Geography and SD Dimensions

Grade	The total number of learning outcomes	The number of learning outcomes associated with SD	SD Dimension	The number of SD learning outcomes
5	28	5	Social	–
			Environmental	5
			Economic	–
7	29	15	Social	5
			Environmental	6
			Economic	4

When the data in Table 11 is examined, it can be seen that the number of learning outcomes in the geography that can be associated with the dimensions of SD is at the 7th grade level at most and at the 5th grade level at the very least. The number of learning outcomes associated with the environmental dimension of SD is seen to be higher than the other dimensions. There have been 5 learning outcomes associated with the social dimension of SD, 11 learning outcomes associated with the environmental dimension, and 4 learning outcomes associated with the economic dimension. Learning outcomes of geography associated with social dimension principles of SD are given in Table 12.

Table 12

The Relationship Between Learning Outcomes of Geography and Social Principles of SD

Learning outcome	Social principles of SD
Grade 7: Students reveal the narrow and broad features of the concept of “European,” as well as the effects and consequences of Europeanism on their daily lives.	A sense of community
Grade 7: Students use examples to explain European political, economic, and cultural cooperation.	A relationship system that values different cultures
Grade 7: Students analyse the culture and way of life in European countries to develop a desire to study for integration into Germany.	A relationship system that values different cultures
Grade 7: Students weigh the benefits and drawbacks of cross-border infrastructure projects for urban agglomeration networking, considering socioeconomic and environmental factors.	A system for communicating social sustainability awareness
Grade 7: Students discuss current developments in metropolises and their impact on the human-environmental system.	A system for communicating social sustainability awareness

According to the data in Table 12, the majority of the geography learning outcomes associated with the social dimension of SD are among the social dimension principles “A relationship system that values different cultures” and “A system for communicating social sustainability awareness.” Learning outcomes of geography associated with environmental dimension principles of SD are given in Table 13.

Table 13

The Relationship Between Learning Outcomes of Geography and Environmental Principles of SD

Learning outcome	Environmental principles of SD
Grade 5: Students demonstrate the need to preserve the world and take their own actions.	Long-term perspective (without any set time limit)
Grade 5: To gain an understanding of the need for landscape protection, students describe the potential uses of selected site examples and discuss the issue of human intervention.	Protecting ecosystem integrity through effective natural resource management
Grade 5: Students describe natural disasters in Bavaria and Germany with their main characteristics and indicate possible simple protective measures.	Flexibility (adaptation to change, learning-by-doing)
Grade 5: Students compare the benefits and drawbacks of conventional and organic farming.	Giving importance to different scales (in terms of time and place)
Grade 5: Students present their own ideas for ensuring the quality of life in areas such as transportation, recreation, community, and infrastructure in a sustainable manner.	Social and environmental interfaces (improving life quality)
Grade 7: Students use digital geomedia to present geographic facts in a structured way, solve problems, and present results.	Flexibility (adaptation to change, learning-by-doing)
Grade 7: Students describe the main characteristics of climate and vegetation in Europe to demonstrate the relationships between climate, soil, and vegetation in a climate zone.	Flexibility (adaptation to change, learning-by-doing)
Grade 7: Students describe the benefits and drawbacks of living in European settlements with volcanic eruptions and earthquakes.	Long-term perspective (without any set time limit)
Grade 7: Students describe spatio-temporal and procedural developments in selected European rural areas.	Giving importance to different scales (in terms of time and place)
Grade 7: Students develop a well-founded opinion about the agricultural potential of the chosen regions in light of natural and anthropogenic factors.	Protecting ecosystem integrity through effective natural resource management
Grade 7: Students explain the importance of protecting seas and coasts and produce a list of precautions.	Protecting ecosystem integrity through effective natural resource management

Table 13 shows that the majority of geography learning outcomes associated with the environmental dimension of SD are “Protecting ecosystem integrity through effective natural resource management” and “Flexibility (adaptation to change, learning-by-

doing).” Learning outcomes of geography associated with economic dimension principles of SD are given in Table 14.

Table 14

The Relationship Between Learning Outcomes of Geography and Economic Principles of SD

Learning outcome	Economic principles of SD
Grade 7: Students explain the main effects of natural factors and economic framework conditions on the use of rural areas in various climatic zones.	Social and environmental impacts of corporations and how they manage them
Grade 7: Students identify the economic, social, and ecological consequences of a controversial agricultural use and generate possible solutions.	Social and environmental impacts of corporations and how they manage them
Grade 7: Students compare the benefits and drawbacks of regional and imported agricultural products and develop action plans when making purchasing decisions.	Social and environmental impacts of corporations and how they manage them
Grade 7: Using selected spatial examples, students state the economic importance of the seas and coasts and explain the problems that arise with their use.	Social and environmental impacts of corporations and how they manage them

According to the data in Table 14, it is seen that all of the geography learning outcomes associated with the economic dimension of SD are “Social and environmental impacts of corporations and how they manage them,” which is one of the economic dimension’s principles.

The Relationship Between Learning Areas of Geography and SD Dimensions

Table 15 shows the learning areas of geography curriculum that are associated with the three dimensions of SD (social, economic, and environmental).

According to the data in Table 15, the learning areas most associated with the dimensions of SD are “natural areas in Bavaria and Germany” from the 5th-grade learning areas and “rural areas of Europe” from the 7th-grade learning areas. It can be seen that the fifth-grade learning area, “Geographical Study Techniques,” is unrelated to any dimension of SD, including social-environmental-economic development.

Table 15

The Relationship Between Learning Areas of Geography and SD Dimensions

Learning area	Grade 5			Learning area	Grade 7				
	Learning outcome	SD-related learning outcome			Learning outcome	SD-related learning outcome			
		Social	Environmental			Economic	Social	Environmental	Economic
Geographical working techniques	10	-	-	Geographical working techniques	7	-	1	-	
Planet Earth	4	-	1	Unity and diversity in Europe	4	3	-	-	
Natural areas in Bavaria and Germany	5	-	2	An overview of Europe's natural geography	5	-	2	-	
Rural areas in Bavaria and Germany	4	-	1	Rural areas of Europe	5	-	2	3	
Urban areas in Bavaria and Germany	5	-	1	Metropolises and agglomerations in Europe	4	2	-	-	
				Europe's seas and coasts	4	-	1	1	
Total	28	-	5	Total	29	5	6	4	

Findings Regarding the Fourth Research Question

The fourth research question of the study, "How is the distribution of learning outcomes and learning areas nature-technology curriculum in Germany (Bavaria) based on the three dimensions of SD (social, environmental, and economic)" and that analysed according to grade levels.

The Relationship Between Learning Outcomes of Nature-Technology and SD Dimensions

Learning outcomes of nature and technology are compared with the dimensions of SD at the grade level, and the results are given in Table 16.

When the data in Table 16 are examined, it is clear that the number of learning outcomes associated with the dimensions of SD in the nature-technology curriculum is the highest in the sixth grade and the lowest in the seventh grade. The number of learning outcomes associated with the environmental dimension of SD is 7, while the number of learning outcomes associated with the economic dimension is 2. Learning outcomes of nature-technology associated with social-environmental-economic dimension principles of SD are given in Table 17.

Table 16

The Relationship Between Learning Outcomes of Nature-Technology and SD Dimensions

Grade	The total number of learning outcomes	The number of learning outcomes associated with SD	SD Dimension	The number of SD learning outcomes
5	60	3	Social	–
			Environmental	3
			Economic	–
6	60	6	Social	–
			Environmental	4
			Economic	2
5	24	–	Social	–
			Environmental	–
			Economic	–

Table 17

The Relationship Between Learning Outcomes Nature-Technology and SD's Social-Environmental-Economic Principles

	Learning outcome	Principles of SD
Dimensions of SD Environmental	Grade 5: Students recognise the importance of light, air, water, soil, and rock to the environment and life, as well as the measures and opportunities that can be realised through environmentally friendly behaviour.	Protecting ecosystem integrity through effective natural resource management
	Grade 5: Students identify various plant types, developing an understanding of the need to protect living things through direct contact with nature.	Care for nature and biodiversity
	Grade 5: Students compare different economic and ecological management systems using simple examples of biodiversity and sustainable development.	Care for nature and biodiversity
	Grade 6: In order to make informed decisions, students compare the consequences of human behaviour to themselves and their environment.	Improving information for decision making (measuring progress through indicators)
	Grade 6: Students explain the essentiality of photosynthesis for life on earth and the energy supply of humanity.	Protecting ecosystem integrity through effective natural resource management
	Grade 6: Students describe various plant reactions triggered by environmental stimuli and explain their importance for plant survival.	Protecting ecosystem integrity through effective natural resource management
	Grade 6: Students generate alternatives for utilising use cases for an ecosystem.	Protecting ecosystem integrity through effective natural resource management

See next page for continuation of table

Continuation of Table 17

Dimensions of SD	Economic	Grade 6: Students compare the benefits and drawbacks of various propagation strategies and demonstrate the relationship between the structure of fruits and seeds and their functions for plant reproduction and propagation.	Social and environmental impacts of corporations and how they manage them
		Grade 6: Students weigh the costs and benefits of sexual and asexual reproduction in seed plants.	Social and environmental impacts of corporations and how they manage them

Table 17 shows that the majority of the nature-technology learning outcomes associated with the environmental dimension of SD are “protecting ecosystem integrity through effective natural resource management” and “care for nature and biodiversity.” It can be stated that the learning outcomes that make up the economic dimension are related to the principle of “social and environmental impacts of corporations and how they manage them.”

The Relationship Between Learning Areas of Nature-Technology and SD Dimensions

Learning areas of nature and technology are compared with the dimensions of SD at the grade level, and the results are given in Table 18.

Table 18

The Relationship Between Learning Areas of Nature-Technology and SD Dimensions

Grade	Learning area	Learning outcome	SD-related learning outcome		
			Social	Environmental	Economic
5	Focus on Scientific Studies	13	–	1	–
	Focus on Biology	47	–	2	–
6	Focus on Biology	46	–	4	2
	Focus on Computer Science	14	–	–	–
7	Explore Physics in Nature and Technology	14	–	–	–
	Focus on Computer Science	10	–	–	–
	Total	144	–	7	2

According to the data in Table 18, it can be stated that “Focus on Biology” among 5th-grade learning areas is the learning area most associated with the dimensions of SD. It is apparent that 7th-grade learning areas are unrelated to any dimension of SD.

According to the research findings, the number of learning outcomes associated with the dimensions of SD in Turkey’s social studies curriculum is close to each other at the 5th, 6th and 7th-grade levels, and the number of learning outcomes associated with the social dimension of SD is higher than the other dimensions. The social dimension principles of the SD are “A sense of community”, “A relationship system that values different cultures”, the environmental dimension principles of the SD are “Giving importance to different scales (in time and space)”, and “Social and environmental impacts of businesses and how they manage them”, and “Social and environmental impacts of corporations and how they manage them” are the economic dimension principles of the

SD that are most associated with social studies learning outcomes. The learning areas most associated with the three dimensions of SD are “Production, Distribution, and Consumption” and “Individual and Society,” which are among the learning areas of the social studies. The learning outcomes of science curriculum that can be associated with the dimensions of SD are most prevalent in the eighth grade and at least in the sixth grade, and all of the associated acquisitions are related to the environmental dimension of SD. “Giving importance to recycling” and “protecting ecosystem integrity through effective natural resource management” are the SD environmental dimension principles most associated with science learning outcomes. “Creatures and Life” is the learning area most associated with the dimensions of SD from the science learning areas. It has been determined that the number of learning outcomes associated with the dimensions of SD in the geography curriculum is highest in 7th grade and lowest in 5th grade, and the number of learning outcomes associated with the environmental dimension of SD is higher than the other dimensions. The social dimension principles of the SD are “A relationship system that values different cultures”, “A system for communicating social sustainability awareness”, the environmental dimension principles of the SD are “Protecting ecosystem integrity through effective natural resource management”, and “Flexibility (adaptation to change, learning-by-doing)”, and “Social and environmental impacts of corporations and how they manage them” are the economic dimension principles of the SD that are most associated with geography learning outcomes. The learning areas most associated with SD dimensions are “natural areas in Bavaria and Germany” from the geography 5th-grade learning areas and “rural areas of Europe” from the geography 7th-grade learning areas. It has been determined that the number of learning outcomes associated with the dimensions of SD in the nature and technology curriculum is highest in 6th-grade and lowest in 5th-grade, and the number of learning outcomes associated with the environmental dimension of SD is higher than the other dimensions. “Protecting ecosystem integrity through effective natural resource management”, “care for nature and biodiversity”, are the environmental dimension principles of the SD, and “the social and environmental effects of corporations and how they manage them” is the economic principle most associated with the learning outcomes of nature and technology. “Focus on Biology,” one of the 5th-grade learning areas of the nature and technology, is the learning area most associated with the dimensions of SD.

Conclusions and Implications

The purpose of this study is to compare the learning outcomes and learning areas of the curricula of Turkey and Germany (Bavaria) in the context of ESD. How ESD is reflected in the curricula of Turkey and Germany (Bavaria) has been examined based on the dimensional (social, environmental, and economic) principles of SD.

ESD is a teaching and learning approach that is based on the principles that underpin sustainability and applies to all levels of education. Three fields of study are included in ESD, which “comprehensively focuses on important issues such as human rights, poverty reduction, sustainable livelihood, environmental education, and gender equality” (Anderson, 2012). These are “environment, society, and economy”. ESD entails a vision that integrates the environment, economy, and society and encourages behavioural changes that will result in a more sustainable future (Anderson, 2012; Mckeown & Hopkins, 2003). According to UNESCO (2015), education ministries and education planners should

review and develop curricula for the delivery of ESD, and new programmes should be flexible enough to adapt to local elements. It emphasized the importance of educators developing new pedagogical approaches by emphasizing the development of new study units as well as critical thinking and problem-solving skills. The importance of ESD was emphasised in the SD report prepared by Turkey's Ministry of Development in 2012, with the curricula to be developed aiming to raise awareness of the next generation. (Teksoz, 2014). Despite the United Nations' broad policies, there is a lack of qualified research on how ESD is implemented in curricula and how it has an impact in the classroom (IALEI, 2009; Nazir et al., 2011).

In light of this information, this study attempted to shed light on how ESD is reflected in education programmes in Turkey and Germany (Bavaria) and how the ESD approach directs education programmes in Bavaria, with examples of the relationship between learning outcomes and ESD principles. According to the findings of the study, the learning outcomes and learning areas of the curricula of Turkey and Germany (Bavaria) are related to the principles of SD (social-environmental-economic), and learning outcomes related to SD dimensions are given more place in the upper grades. The social dimension principles of Turkey's social studies curriculum, the environmental dimension principles of the science curriculum, and the environmental dimension principles of Germany's (Bavaria) geography, nature and technology curricula have been determined to be more related. The number of learning outcomes related to the economic dimension principles of SD in both countries' curricula has been determined to be very low. Singer-Brodowski et al. (2019) studied the impacts of ESD in various educational settings in Germany and stated that innovation systems should be developed. This finding shows that the number of learning outcomes associated with the economic dimension principles of ESD is low. Aside from that, it has been found that, in contrast to Turkey's curricula, Germany's (Bavaria) curricula aim to develop high-level thinking skills and are based on the Climate Change Education approach for SD. For sustainability, it was determined that the students' problem-solving skills provided solutions to existing environmental, social, and economic problems, and the acquisitions, along with case study activities, were included. Research on SD emphasizes both the impact of ESD and the deficiencies in the curriculum in Turkey and Germany (Aktas et al., 2020; Ates, 2019; Bagoly-Simó, 2013; Barak & Gonençgil, 2020; Bormann & Nickel, 2017; Dannenberg & Grapentin, 2016; Demirbas, 2011; Grund & Brock, 2020; Hacet & Demir, 2019; Kaya & Tomal, 2011; Korkmaz, 2020; Singer-Brodowski et al., 2019; Tanrıverdi, 2009).

Dannenberg and Grapentin (2016) revealed the deficiencies and difficulties, as well as significant acquisitions, in the integration of ESD into Germany's education system. Bagoly-Simó (2013), identifying 46 topics related to ESD, examined the secondary school curriculum in Germany (Bavaria) according to the ESD approach and found that climate change issues were given more attention. Bormann and Nickel (2017) examined the process of ESD implementation in the context of educational administration in Germany. Singer-Brodowski et al. (2019) examined the effect of ESD on Germany's educational system, and they identified a lack of innovative systems. Grund and Brock (2020) emphasised in their study that teachers and students in Germany want more ESD-related curricula. Barak and Gonençgil (2020) stated that in Bavarian curricula, geographic information systems are used in addition to teaching-learning strategies following the ESD approach recommended by UNESCO and activities such as discussion and ideation and project design.

Tanrıverdi (2009) compared the learning outcomes of primary education programmes in Turkey by associating them with seven environmental-centred basic priorities included in the European Union Commission's SD Strategy and was able to associate the learning outcomes of primary education programmes primarily with two basic priorities (clean energy and protection of natural resources). Hacı and Demir (2019) compared the 2018 social studies curriculum to these seven basic priorities and concluded that more space should be allocated proportionally in the context of grade level-learning areas. Korkmaz (2020) compared Turkey's teacher training undergraduate courses with the three dimensions of SD (environmental, social, and economic) and could only associate them with elective courses. Kaya and Tomal (2011) compared the social studies curriculum's aims, skills, values, acquisitions, and learning areas to the competencies and values that individuals should acquire as a result of ESD and concluded that more space should be given proportionally. Ateş (2019) compared the objectives and learning outcomes of Turkey's science Curriculum to the United Nations Development Program's 17 SD goals and discovered a grade-level disparity. Aktaş et al. (2020) compared Turkey's primary education programmes to the UN's 2030 SD Goals and found similar results. Demirbaş (2011) investigated the connection between the geography curriculum and SD in terms of learning outcomes, learning areas, skills, and measurement tools. When SD acquisitions and activities were compared by grade level, it was discovered that they were not consistent.

According to the findings of the study, there is a need in this field for curriculum development studies that are designed using the ESD approach. It is especially recommended to include more acquisitions related to the social, environmental, and economic dimensions of SD principles in the programmes to be developed.

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