International Journal of Contemporary Approaches in Education (IJCAE) 2025
Volume 4 (1) Page 21 - 45
https://doi.org/10.29329/ijcae.2025.1312.2

Türkiye Century Education Model: An Analysis of the 2024 Science Curriculum within the Framework of Sustainable Development Goals*

Zühal Ulusoy Murteza [1*], Sertel Altun [2]

Abstract

This study employs document analysis and descriptive analysis techniques to examine the integration level of the 2024 Türkiye Century Education Model Science Curriculum (TYMM FBDÖP) with the United Nations Sustainable Development Goals (SDGs). The research systematically evaluates the extent to which the curriculum addresses SDGs across specific objectives, implementation principles, interdisciplinary components, and grade-level learning outcomes. Findings indicate that the curriculum demonstrates strength in incorporating environmental sustainability-related SDGs ("Climate Action," "Life Below Water," "Life on Land"), while social and economic dimensions ("No Poverty," "Gender Equality," "Reduced Inequalities") remain underrepresented. Among specific objectives, "Quality Education" (21%) is prominent, whereas implementation principles show limited SDG integration (69% exclusively addressing "Quality Education"). Interdisciplinary components indicate a strong emphasis on environmental themes within the virtue–value–action framework, whereas themes related to social justice and equality appear to be insufficiently represented. Descriptive analysis by grade level shows that the proportion of SDG-related learning outcomes increases from 21% in 5th grade to 44% in 8th grade. However, SDGs 4, 5, 8, 16, and 17 are absent at all levels, suggesting the curriculum fails to fully reflect the multidimensionality of sustainable development.The study recommends preserving the environmental focus of science education while integrating social and economic SDGs, enhancing teacher training, and developing interdisciplinary approaches. These findings, derived through document analysis, provide critical insights for advancing sustainable development perspectives in Türkiye's science education curricula.

Keywords: Science education, sustainability, Sustainable Development Goals (SDGs), Education for Sustainable Development (ESD).

Received: 21.05.2025 – **Accepted:** 23.06.2025 – **Published:** 24.06.2025

* This study is derived from the master's thesis prepared by the corresponding author in the Department of Curriculum and Instruction, Graduate School of Social Sciences, Yıldız Technical University.

[1] **Zühal Ulusoy Murteza,** Yıldız Technical University, İstanbul, Türkiye. ORCID: 0009-0000-8734-0435, zuhalulsy@gmail.com
[*] **Correspondence:** zuhalulsy@gmail.com

[2] **Sertel Altun,** Yıldız Technical University, İstanbul, Türkiye. ORCID: 0000-0002-1951-5181, saltin@yildiz.edu.tr

INTRODUCTION

Human interaction with nature is a process as ancient as human history itself. As the global population has grown over time, urbanization and consumption levels have risen dramatically, creating immense pressure on natural resources. The Industrial Revolution marked a turning point where human activities began exerting increasingly severe impacts on ecosystems, primarily due to uncontrolled exploitation of natural resources. European nations competing in industrialization aggressively harvested forests and other natural assets to fuel their factories' growing demands for raw materials and energy. Today, rapidly expanding populations, accelerating urbanization, and ever-increasing consumption patterns continue to intensify this pressure on finite natural resources. The escalating environmental damage caused by unchecked production and consumption has made the concept of sustainability not just relevant but imperative. The environmental crisis has demonstrated that any development model must respect planetary boundaries and remain within Earth's carrying capacity (Worster, 1993).

The Brundtland Report of 1987 by the World Commission on Environment and Development (WCED) established the foundational definition of sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." This conceptualization expanded the discourse beyond purely environmental concerns to incorporate crucial social dimensions including equity, cultural preservation, and economic justice. Sustainable development inherently encompasses three interdependent pillars - environmental protection, social progress, and economic growth - that must be carefully balanced through interdisciplinary approaches. This tripartite framework acknowledges humanity's historical relationship with nature while emphasizing the critical importance of maintaining harmony between these dimensions for future sustainability (Harris, 2000).

The United Nations 2030 Agenda for Sustainable Development, adopted in 2015, built upon the Millennium Development Goals by introducing a more comprehensive framework comprising 17 Sustainable Development Goals (SDGs) and 169 specific targets. These goals address pressing global challenges ranging from poverty eradication and quality education to climate action, gender equality, and the development of peaceful institutions (UNDP, 2015).

Figure 1. *The Sustainable Development Goals (SDGs)*

(Source: https://sdgs.un.org/goals)

Education for Sustainable Development (ESD) has emerged as a transformative educational paradigm. UNESCO's 2014 definition characterizes ESD as a multidimensional educational process that equips learners with the knowledge and skills to balance environmental, social, and economic considerations when addressing current and future needs. Unlike traditional environmental education, ESD adopts an interdisciplinary approach to complex global issues like climate change, poverty, inequality, and resource distribution, while emphasizing ethical values, lifelong learning competencies, and multiple perspectives. Although the concept gained formal recognition through UN adoption in 1987, its intellectual origins can be traced to the 1977 Tbilisi Conference and the seminal Our Common Future report. The UN's designation of 2005-2014 as the Decade of Education for Sustainable Development represented a crucial phase for establishing stakeholder collaborations, enhancing educational quality, and integrating ESD principles into existing education systems (Alkış, 2009).

Recent UNESCO guidelines (2017) emphasize the need for curricular reforms that adopt interdisciplinary approaches to sustainability, integrating environmental, economic and social dimensions into a cohesive framework. Scholars like McKeown and Hopkins (2007) highlight the importance of comprehensive teacher training programs to ensure educators can effectively implement sustainability education. Wals (2012) further underscores that meaningful ESD implementation requires active participation from all societal stakeholders throughout the educational process to achieve widespread acceptance and impact.

The successful implementation of ESD depends on several critical factors: the systematic redesign of curricula through sustainability lenses, robust support for teacher professional development, inclusive engagement of diverse stakeholders, and the integration of theoretical

knowledge with practical applications. These elements collectively form the foundation for effective sustainability education that can address contemporary global challenges while preparing learners for future uncertainties.

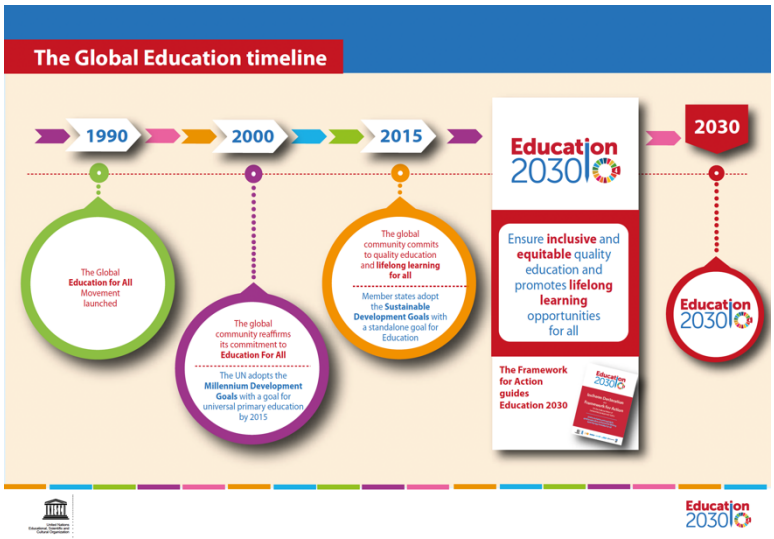

Figure 2. The Global Education Timeline

(Source: https://en.unesco.org/themes/education2030-sdg4/timeline*)*

The current era of technology and information has been largely shaped by advancements in science. Effective science education for students holds critical importance (Demirer, 2006). Science education encompasses not only knowledge about the world, environment, human anatomy, and health but also the transmission of essential life skills (Gürdal, 1991). In today's rapidly evolving technological landscape, the scientific literacy of citizens plays a pivotal role in a nation's ability to achieve the SDGs. Consequently, countries prioritize investments in science education to enhance human capital and foster innovation. Given the centrality of science in modern life, science curricula emerge as indispensable tools for equipping students with this knowledge. These curricula aim to develop students' scientific process skills, deepen their understanding of nature, and cultivate environmentally conscious individuals. By stimulating curiosity, they encourage scientific exploration. The Science Curriculum (FBDÖP) seeks to nurture scientifically literate students who possess sustainability awareness and exhibit sensitivity toward environmental and societal challenges (MoNE, 2018).

Beyond theoretical knowledge transmission, education systems increasingly emphasize raising awareness of sustainability-related issues such as global warming, energy crises, scientific literacy, and biodiversity, aligning with growing global concerns (Bencze et al., 2013; van Eijck &

Roth, 2007). Science education enables students to engage with and comprehend nature while fostering the development of environmentally and socially aware individuals capable of designing a sustainable world (Johnston, 2011). Sustainability is inherently intertwined with science education, with topics like climate change, clean energy, water conservation, and biodiversity addressed through interdisciplinary approaches (Ateş, 2019; Pauw et al., 2015). At the primary and secondary levels, science courses play a crucial role in imparting sustainability principles. However, effective teaching in this domain requires enhanced teacher competencies (Bilgili, 2017). Notably, pre-service teachers' awareness of environmental issues significantly influences their ability to instill sustainability consciousness in future students (Çankaya, 2014).

Integrating sustainability into science education not only enhances students' inquiry skills but also promotes sustainable behaviors in daily life (Eroğlu & Bektaş, 2016). For instance, sustainability-focused STEM activities increase student engagement and facilitate meaningful learning. Despite this, research on sustainability in science education remains limited (Lourdel et al., 2005). Existing studies predominantly focus on scale development and student attitudes (Gayford, 2001; Ko & Lee, 2003), underscoring the need for more qualitative and applied research.

Studies in Türkiye reveal partial integration of sustainability into curricula, with notable gaps in implementation. Analyses of social studies (Kaya & Tomal, 2011), geography (Demirbaş, 2011), and science (Özgür, 2020) curricula indicate the presence of sustainability-related outcomes but deficiencies in skill development and interdisciplinary connections (Aytar & Özsevgeç, 2019). Research on teachers and pre-service teachers yields striking findings: while awareness levels are generally high (Dal & Akçay, 2021; Şüheda & Akçay, 2021), this knowledge often fails to translate into classroom practices. Challenges include students' difficulties in converting knowledge into action (Demir & Atasoy, 2021) and curricula lacking participatory activities (Dere & Çınkaya, 2023). These findings suggest the need to strengthen practical implementation, restructure teacher training, and develop interdisciplinary approaches to enhance sustainability education in Türkiye.

The Türkiye Century Education Model (TYMM), implemented in 2024, represents a paradigm shift in integrating SDGs into education (MoNE, 2024). Its hallmark is a holistic approach centered on "virtue-value-action," moving beyond knowledge-based education to empower students to apply sustainability principles in daily life. A key commitment in MoNE's 2024–2028 Strategic Plan is developing a Science Curriculum (FBDÖP) aligned with SDG 4 (Quality Education) and SDG 13 (Climate Action), reflecting Türkiye's 2030 Education Vision (MoNE, 2023). While the 2024 TYMM FBDÖP aims to cultivate scientific literacy and sustainability awareness, its alignment with the UN SDGs and contribution to these goals remain underexplored.

Research Purpose and Questions

This study examines the extent to which the 2024 TYMM FBDÖP incorporates and contributes to the UN SDGs. The following research questions guide the inquiry:

1. How are SDGs addressed in the "philosophy and specific objectives" section of the 2024 TYMM Middle School FBDÖP?
2. How are SDGs addressed in the "implementation principles" section of the curriculum?
3. How are SDGs addressed in the "interdisciplinary components" section?
   3.1.1. How do social-emotional learning skills reflect SDGs?
   3.1.2. How does the "virtue-value-action" framework address SDGs?
   3.1.3. How are systems thinking and literacy skills aligned with SDGs?
4. What proportion of learning outcomes across all grade levels explicitly address SDGs?
5. What is the distribution of SDG-related learning outcomes per grade level (5th–8th)?

METHODOLOGY

This qualitative study employs document analysis to evaluate the integration of SDGs in the TYMM FBDÖP. Document analysis involves systematic examination of written materials to uncover patterns and meanings (Yıldırım, Şimşek, 2016). Data sources may include public records, official reports, or private documents like letters and diaries (Creswell, 2017). In educational research, textbooks, curricula, administrative correspondence, and student records frequently serve as data (Kearney, Tashlik, 1985). For this study, the 2024 TYMM FBDÖP and related policy documents constitute the primary data, analyzed through categorical aggregation and thematic coding to identify SDG linkages.

Data Sources

The data for this research consists of two primary components: the officially approved and implemented 2024 TYMM FBDÖP authorized by the Board of Education (TTKB), and the 17 SDGs adopted by the United Nations. The curriculum document was accessed through the official TYMM website (https://tymm.meb.gov.tr/), while the SDGs were obtained from the official MoNE website.

Data Analysis

This study employed descriptive analysis for document examination. Descriptive analysis involves systematically interpreting and summarizing collected data within predetermined thematic

frameworks (Yıldırım & Şimşek, 2021). The analysis specifically focused on the curriculum's learning outcomes in relation to the 17 SDGs, with data systematically presented and interpreted.

To ensure methodological reliability, the study was guided by the qualitative research criteria proposed by Guba (1981). Multiple verification mechanisms were implemented to maintain objectivity throughout data collection, analysis, and interpretation processes. A three-stage validation system was developed for this purpose. First, independent expert opinions were sought during document analysis to test the consistency of the analytical framework. Second, a panel consisting of one doctoral-level expert in science education and two field specialists with ten years of professional experience were asked to interpret the data. Finally, Miles and Huberman's (1994) consensus formula was applied, resulting in a 90% inter-rater agreement rate, which exceeds the acceptable threshold of 70%, indicating the reliability of research findings.

To enhance the study's transferability, all data collection and analysis processes were thoroughly documented using an audit trail technique. This approach provided the necessary methodological transparency for other researchers to replicate the process and compare results. These comprehensive measures strengthened both the internal and external validity of the study, thereby increasing the scientific value of the findings. The rigorous application of these methods at every stage of the research process established a solid foundation supporting the study's credibility and applicability to other contexts.

Ethical Considerations

This research strictly adhered to scientific research ethics guidelines. All documents used were publicly available, officially published materials that contained no personal data or confidential information. Throughout the research process, academic integrity and ethical principles were meticulously observed. The study maintained complete transparency in methodology and reporting, ensuring compliance with all relevant ethical standards in educational research. Proper attribution was given to all sources and documents referenced in the study.

FINDINGS

This section presents the interpretation of findings according to the research sub-problems.

1. Integration of Sustainable Development Goals in the "Philosophy and Specific Objectives" Section of the 2024 Türkiye Century Education Model Middle School Science Curriculum

The specific objectives of the 2024 TYMM FBDÖP were analyzed in the context of the 2030 SDGs, with results presented in Table 1.

Table 1. Frequency of 17 Sustainable Development Goals in the Specific Objectives of the Science Curriculum

UN 2030 SDGs	TYMM Specific Objectives	f	%
No Poverty	-	-	-
Zero Hunger	-	-	-
Good Health and Well-being	Article 12	1	2
Quality Education	Article 1, 2, 3, 5, 6, 8, 9, 10	8	21
Gender Equality	-	-	-
Clean Water and Sanitation	Article 4	1	2
Affordable and Clean Energy	Article 3, 4, 5	3	7
Decent Work and Economic Growth	Article 11	1	2
Industry, Innovation and Infrastructure	Article 3, 5	2	5
Reduced Inequalities	-	-	-
Sustainable Cities and Communities	Article 3, 4, 7, 11	4	10
Responsible Consumption and Production	Article 3, 4, 5	3	7
Climate Action	Article 1, 3, 4, 5	4	10
Life Below Water	Article 1, 3, 4	3	7
Life on Land	Article 1, 3, 4	3	7
Peace, Justice and Strong Institutions	Article 5, 6, 7, 10	4	10
Partnerships for the Goals	Article 4, 6, 7, 10	4	10
Total		**41**	**100**

Analysis of Table 1 shows connections between the TYMM FBDÖP specific objectives and the SDGs. The most frequently referenced SDG is "Quality Education" (f=8). The least referenced SDGs are "Good Health and Well-being" (f=1), "Clean Water and Sanitation" (f=1), and "Decent Work and Economic Growth" (f=1). The SDGs not included at all are "No Poverty", "Zero Hunger", "Gender Equality", and "Reduced Inequalities".

In the "specific objectives" section of the TYMM FBDÖP, several items are provided that are associated with the SDGs.

Regarding the goal of “Good Health and Well-Being,” the 12th specific objective in the TYMM FBDÖP states: *Raising individuals who act in accordance with safety rules in daily life and scientific studies* (MoNE, 2024).

In connection with the goal of “Quality Education,” the 1st specific objective includes the statement: *Possessing fundamental knowledge of physics, chemistry, biology, astronomy, and earth and environmental sciences* (MoNE, 2024).

In relation to the goal of "Affordable and Clean Energy," the 3rd specific objective reads: *Being aware of the role of digital transformation in the development of science, adapting to changing technology, and using technology effectively with environmental awareness* (MoNE, 2024).

Concerning the goal of "Partnerships for the Goals," the 6th specific objective emphasizes: *Possessing virtues aligned with universal, national, and cultural values and putting these virtues into action* (MoNE, 2024).

2. How Are the SDGs Addressed in the "Principles for Implementation of the Curriculum" Section of the 2024 Türkiye Century Maarif Model Science Course Curriculum for Middle School?

The 2024 TYMM FBDÖP was examined within the context of the 2030 SDGs by analyzing the section titled "Principles for Implementation of the Curriculum." The findings are presented in Table 2.

Table 2. The Inclusion of the 17 Sustainable Development Goals in the "Principles for Implementation of the Curriculum" Section of the Science Course Curriculum

UN 2030 SDG	**TYMM – Principles for Implementation**	**f**	**%**
No Poverty	–	–	–
Zero Hunger	–	–	–
Good Health and Well-Being	Article 5	1	8
Quality Education	Article 1, Article 2, Article 3, Article 5, Article 6, Article 7, Article 8, Article 9, Article 13	9	69
Gender Equality	–	–	–
Clean Water and Sanitation	–	–	–
Affordable and Clean Energy	–	–	–
Decent Work and Economic Growth	–	–	–
Industry, Innovation and Infrastructure	–	–	–
Reduced Inequalities	Article 7, Article 8, Article 9	3	23
Sustainable Cities and Communities	–	–	–
Responsible Consumption and Production	–	–	–
Climate Action	–	–	–
Life Below Water	–	–	–
Life on Land	–	–	–
Peace, Justice and Strong Institutions	–	–	–
Partnerships for the Goals	–	–	–
Total		**13**	**100**

As shown in Table 2, the “Principles for Implementation of the Curriculum” section of the TYMM FBDÖP is associated with three SDGs. Among these, the most frequently addressed SDG is “Quality Education” (f=9), while “Good Health and Well-Being” (f=1) and “Reduced Inequalities” (f=3) are the least represented. No associations were identified between the remaining SDGs and the implementation principles of the curriculum.

In the “Principles for Implementation of the Curriculum” section of the 2024 TYMM FBDÖP, certain articles are explicitly related to the SDGs. Regarding the goal of “Good Health and Well-Being,” Article 5 states: *A classroom climate should be created where students’ active participation is ensured, thoughts are freely expressed, and the development of social and emotional skills is supported* (MoNE, 2024).

3. How Are the SDGs Addressed in the "Cross-Curricular Components" Section of the 2024 Türkiye Century Maarif Model Science Course Curriculum for Middle School?

In the TYMM curricula, the cross-curricular components represent essential sections that support the achievement of learning outcomes. These components include three main areas: social-emotional learning skills, the virtue–value–action framework, and systems thinking and literacy skills (MoNE, 2024).Each component was analyzed in terms of its inclusion of the SDGs, and the results are presented in tables.

3.1. How Are the SDGs Addressed in Social-Emotional Learning Skills?

Social-emotional learning skills are defined as the competencies that aim to help students adapt to social life, manage emotions, and express themselves, integrating cognitive, affective, and social development processes (MoNE, 2024).The TYMM framework emphasizes the development of these skills in both in-school and out-of-school settings. In this section, how the SDGs are incorporated into the social-emotional skills component of the SCC is examined, and the findings are presented in Table 3.

Table 3. The Inclusion of the 17 Sustainable Development Goals in the Social-Emotional Learning Skills Component of the Science Course Curriculum

UN 2030 SDGs	TYMM Social-Emotional Learning Skills	f	%
No Poverty	-	-	-
Zero Hunger	-	-	-
Good Health and Well-being	Self-awareness Self-management Self-regulation	3	16
Quality Education	Communication	1	5
Gender Equality	Communication Collaboration Social awareness	3	16
Clean Water and Sanitation	-	-	-
Affordable and Clean Energy	-	-	-
Decent Work and Economic Growth	-	-	-
Industry, Innovation and Infrastructure	-	-	-
Reduced Inequalities	Social awareness Adaptability Resilience	3	16
Sustainable Cities and Communities	-	-	-
Responsible Consumption and Production	Responsible decision-making	1	5
Climate Action	Responsible decision-making	1	5
Life Below Water	Responsible decision-making	1	5
Life on Land	Responsible decision-making	1	5
Peace, Justice and Strong Institutions	Responsible decision-making Communication Social awareness Adaptability	4	22
Partnerships for the Goals	Collaboration	1	5
Total		**19**	**100**

Table 3 shows that connections were made with 10 SDGs in the social-emotional skills section of the TYMM FBDÖP. The most frequently connected SDG was "Peace, Justice and Strong Institutions" (f=4). The least connected SDGs were "Quality Education", "Responsible Consumption and Production", "Climate Action", "Life Below Water", "Life on Land" and "Partnerships for the Goals" (f=1 each). "Good Health and Well-being", "Gender Equality" and "Reduced Inequalities" showed moderate connections (f=3). No connections were made with the remaining SDGs in the social-emotional skills section.

For the "Quality Education" goal, the TYMM FBDÖP communication skill item states: "SDB2.1.SB1: Listening to others effectively" (MoNE, 2024).

Regarding "Gender Equality," the social awareness items include: "SDB2.3.SB3: Developing understanding and showing respect towards others" and "SDB2.3.SB4: Developing an understanding of social norms" (MoNE, 2024).

For "Peace, Justice and Strong Institutions," the adaptation skill item states: "SDB3.1.SB5: Adjusting emotional responses to successfully interact with new, changing, and uncertain environments" (MoNE, 2024).

3.2 Integration of SDGs in the Virtue-Value-Action Framework

The curriculum's Virtue-Value-Action framework proposes a value system structured around core values such as respect, responsibility, and justice. These foundational values intersect with and support all other values in the system (MoNE, 2024).This section examines how SDGs are incorporated into the Virtue-Value-Action component of the TYMM FBDÖP, with results presented in Table 4.

Table 4. Inclusion of the 17 SDGs in the Virtue-Value-Action Component of the Science Curriculum

UN 2030 SDGs	TYMM Values	f	%
1. No Poverty	Compassion Mercy Sensitivity	3	6
2. Zero Hunger	Compassion Mercy Sensitivity	4	8
3. Good Health and Well-being	Health and Quality Living Cleanliness	2	4
4. Quality Education	Diligence	1	2
5. Gender Equality	Respect Love	2	4
6. Clean Water and Sanitation	Sensitivity Healthy Living Cleanliness	3	6
7. Affordable and Clean Energy	Sensitivity Conservation Cleanliness	3	6
8. Decent Work and Economic Growth	Diligence	1	2
9. Industry, Innovation and Infrastructure	-	-	-
10. Reduced Inequalities	Justice Privacy Love	3	6
11. Sustainable Cities and Communities	-	-	-
12. Responsible Consumption and Production	Sensitivity Conservation Responsibility Diligence Modesty	5	10
13. Climate Action	Sensitivity Responsibility Mercy Respect Cleanliness	5	10
14. Life Below Water	Sensitivity Responsibility Cleanliness Mercy Respect	5	10
15. Life on Land	Sensitivity Responsibility Cleanliness Mercy Respect	5	10
16. Peace, Justice and Strong Institutions	Justice Respect Love Honesty Freedom Patriotism Patience	7	14
17. Partnerships for the Goals	Friendship	1	2
Total		**50**	**100**

The most prominently addressed SDG is "Peace, Justice and Strong Institutions" (SDG 16) with seven connections (f=7). Three SDGs show minimal representation with single connections each (f=1): "Quality Education" (SDG 4), "Decent Work and Economic Growth" (SDG 8), and

"Partnerships for the Goals" (SDG 17). Moderate integration is observed for "Life Below Water" (SDG 14) and "Life on Land" (SDG 15) with six connections each (f=6), followed by "Responsible Consumption and Production" (SDG 12) and "Climate Action" (SDG 13) with five connections each (f=5). "Zero Hunger" (SDG 2) appears four times (f=4), while four SDGs - "No Poverty" (SDG 1), "Clean Water and Sanitation" (SDG 6), "Affordable and Clean Energy" (SDG 7), and "Reduced Inequalities" (SDG 10) - each show three connections (f=3). Two SDGs demonstrate two connections each (f=2): "Good Health and Well-being" (SDG 3) and "Gender Equality" (SDG 5).

Examples from the Virtue-Value-Action Component

The SCC includes specific examples of SDG integration within its virtue-value-action framework:

For "No Poverty" (SDG 1), the compassion component states: "D20.1.1. Shares material possessions with those in need according to one's means" (MoNE, 2024).

Regarding "Zero Hunger" (SDG 2), the mercy component includes: "D9.2.3. Behaves patiently and understandingly towards people in need of help" (MoNE, 2024).

The cleanliness component for "Affordable and Clean Energy" (SDG 7) contains: "D18.3.5. Understands the importance of clean energy sources for environmental and community health," while the sensitivity component states: "D5.2.2. Values the use of clean energy sources" (MoNE, 2024).

For "Climate Action" (SDG 13), the cleanliness component includes: "D5.2.4. Makes consumption choices that contribute to sustainability," and the respect component states: "D14.3.1. Protects nature and living beings" (MoNE, 2024).

Regarding "Life on Land" (SDG 15), the aesthetics component contains: "D5.2.4. Makes consumption choices that contribute to sustainability," while the sensitivity component includes: "D5.2.6. Shows willingness to learn about living species in one's environment" (MoNE, 2024).

3.3 Integration of SDGs in Systems Thinking and Literacy Skills

The TYMM approaches literacy skills through a three-phase framework: (1) enabling students to define and understand fundamental knowledge, terms, concepts, and phenomena while developing awareness and sensitivity; (2) facilitating comprehension of holistic relationships between learned concepts in subsequent sections; and (3) ultimately aiming to translate acquired concepts into action (MoNE, 2024).

Table 5. Inclusion of 17 SDGs in the Science Curriculum's Literacy Skills Section

UN 2030 SDGs	TYMM Literacy Skills	f	%
1. No Poverty	Sustainability literacy	1	3
2. Zero Hunger	Sustainability literacy	1	3
3. Good Health and Well-being	Sustainability literacy	1	3
4. Quality Education	Sustainability literacy Information literacy Visual literacy Digital literacy Art literacy Cultural literacy Financial literacy Data literacy Civic literacy	9	37
5. Gender Equality	Sustainability literacy	1	3
6. Clean Water and Sanitation	Sustainability literacy	1	3
7. Affordable and Clean Energy	Sustainability literacy	1	3
8. Decent Work and Economic Growth	Sustainability literacy Financial literacy	2	8
9. Industry, Innovation and Infrastructure	Sustainability literacy	1	3
10. Reduced Inequalities	Sustainability literacy	1	3
11. Sustainable Cities and Communities	Sustainability literacy Cultural literacy	2	8
12. Responsible Consumption and Production	Sustainability literacy	1	3
13. Climate Action	Sustainability literacy	1	3
14. Life Below Water	Sustainability literacy	1	3
15. Life on Land	Sustainability literacy	1	3
16. Peace, Justice and Strong Institutions	Sustainability literacy Civic literacy	2	8
17. Partnerships for the Goals	Sustainability literacy	1	3
Total		**28**	**100**

Table 5 shows that all 17 SDGs are connected through sustainability literacy in the Science Curriculum's literacy skills section. The most frequently connected SDG is "Quality Education" (SDG 4) with nine literacy skill connections (f=9). Four SDGs - "Sustainable Cities and Communities" (SDG 11), "Decent Work and Economic Growth" (SDG 8), and "Peace, Justice and Strong Institutions" (SDG 16) - each have two connections (f=2). Thirteen SDGs show minimal connection with one literacy skill each (f=1): "No Poverty" (SDG 1), "Zero Hunger" (SDG 2), "Good Health and Well-being" (SDG 3), "Gender Equality" (SDG 5), "Clean Water and Sanitation" (SDG 6), "Affordable and Clean Energy" (SDG 7), "Industry, Innovation and Infrastructure" (SDG 9), "Reduced Inequalities" (SDG 10), "Responsible Consumption and Production" (SDG 12), "Climate Action" (SDG 13), "Life Below Water" (SDG 14), "Life on Land" (SDG 15), and "Partnerships for the Goals" (SDG 17).

2024 TYMM FBDÖP Literacy Section SDG-Related Sample Items:

For SDG 4 (Quality Education), the information literacy component states: "OB1.5.SB1. Questions information; OB1.5.SB2. Uses information to reason about

events/issues/situations/problems; OB1.5.SB3. Reflects on conclusions reached through reasoned use of information" (MoNE, 2024).

For SDG 8 (Decent Work and Economic Growth), the financial literacy component includes: "OB3.5.SB1. Recognizes financial technologies; OB3.5.SB2. Uses financial technologies" (MoNE, 2024).

For SDG 9 (Industry, Innovation and Infrastructure), the sustainability literacy component contains:
"OB8.8. Implements Developed Solution Proposals for System Sustainability" (MoNE, 2024).

For SDG 16 (Peace, Justice and Strong Institutions), the sustainability literacy component states:
"OB8.8.SB5. Initiates and strengthens system change through actions" (MoNE, 2024).

4. Analysis of SDG-Inclusive Learning Outcomes Across Grade Levels in the 2024 Türkiye Century Education Model Middle School Science Curriculum

The distribution of all learning outcomes in the TYMM FBDÖP that incorporate SDGs has been examined by grade level, with results presented in Table 6.

Table 6. Distribution of SDG-Related Learning Outcomes by Grade Level

Grade Level	Total Learning Outcomes	SDG-Related Outcomes	Percentage (%)
5th Grade	28	6	21
6th Grade	36	14	39
7th Grade	36	11	30
8th Grade	43	19	44
Total	**143**	**50**	**35**

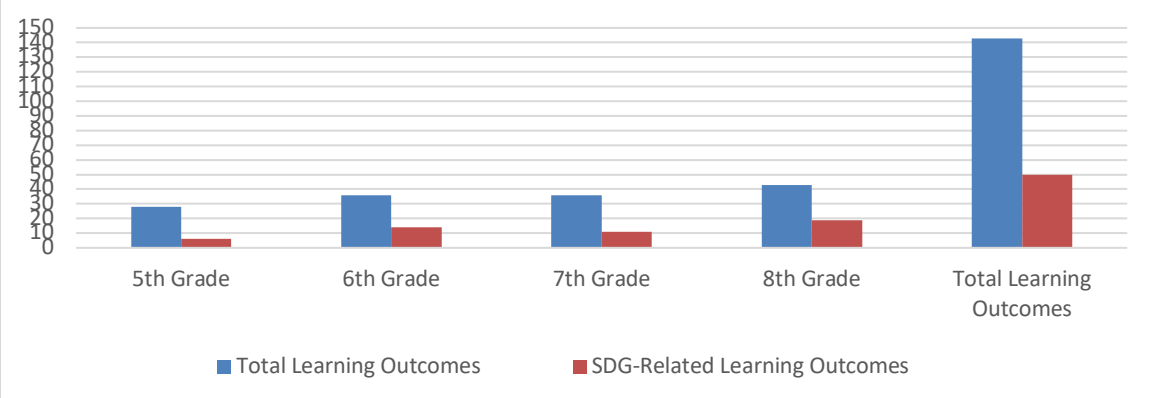

Figure 3. Distribution of Learning Outcomes Related to the Sustainable Development Goals by Grade Level

A total of 143 learning outcomes from grades 5, 6, 7, and 8 were analyzed within the scope of this study. Of these, 55 learning outcomes, corresponding to 35%, were found to be directly or indirectly related to at least one Sustainable Development Goal (SDG). According to the table, at the 5th-grade level, 6 out of 28 learning outcomes (21%) are associated with the SDGs; at the 6th grade, 14 out of 36 (39%); at the 7th grade, 11 out of 36 (30%); and at the 8th grade, 19 out of 43 (44%). The proportion of SDG-related learning outcomes at the 8th-grade level is higher compared to other grade levels.

5. What is the proportion of learning outcomes related to each SDG among the learning outcomes at the 5th, 6th, 7th, and 8th-grade levels in the 2024 Türkiye Century Maarif Model Middle School Science Course Curriculum?

An analysis was conducted to determine the extent to which each of the 17 SDGs is represented within the learning outcomes of the 2024 TYMM FBDÖP, and the results are presented in Table 7.

Table 7. Distribution of Learning Outcomes Related to the SDGs by Grade Level

UN 2030 SDGs	5th Grade	6th Grade	7th Grade	8th Grade	Total
1. No Poverty	3	-	1	-	4
2. Zero Hunger	-	-	1	-	1
3. Good Health and Well-being	3	7	9	7	26
4. Quality Education	-	-	-	-	-
5. Gender Equality	-	-	-	-	-
6. Clean Water and Sanitation	3	1	1	3	8
7. Affordable and Clean Energy	-	3	-	6	9
8. Decent Work and Economic Growth	-	-	-	-	-
9. Industry, Innovation and Infrastructure	-	1	-	1	2
10. Reduced Inequalities	-	-	-	-	-
11. Sustainable Cities and Communities	3	3	1	6	13
12. Responsible Consumption and Production	3	5	1	5	14
13. Climate Action	3	8	2	13	26
14. Life Below Water	3	9	2	9	23
15. Life on Land	3	8	2	9	22
16. Peace, Justice and Strong Institutions	-	-	-	-	-
17. Partnerships for the Goals	-	-	-	-	-
Total	**24**	**45**	**20**	**59**	

According to Table 7, the learning outcomes analyzed in the 2024 TYMM FBDÖP most frequently correspond to the SDGs of “Good Health and Well-Being” and “Climate Action,” each matching with 26 learning outcomes. These are followed by “Life Below Water” with 23 learning outcomes and “Life on Land” with 22 learning outcomes. “Responsible Consumption and Production” is associated with 14 learning outcomes, “Sustainable Cities and Communities” with 13, “Affordable

and Clean Energy" with 9, "Clean Water and Sanitation" with 8, "No Poverty" with 4, "Industry, Innovation and Infrastructure" with 2, and "Zero Hunger" with 1 learning outcome.

In contrast, no learning outcomes were linked to the goals of "Quality Education," "Gender Equality," "Reduced Inequalities," "Peace, Justice and Strong Institutions," and "Partnerships for the Goals." Some learning outcomes are matched with a single SDG, while others correspond to multiple SDGs. Therefore, there is a discrepancy between the total number of learning outcomes matched with SDGs and the total number of matches per SDG.

When examining the distribution of SDGs across grade levels, it was observed that different goals appear at varying rates across grades. At the 5th-grade level, 24 learning outcomes were found to be related to the SDGs, as shown in Figure 4. The most frequently associated SDGs at this level are "Life Below Water," "Life on Land," "Climate Action," "Sustainable Cities and Communities," and "Responsible Consumption and Production." No learning outcomes were found to be associated with certain SDGs such as "Zero Hunger," "Quality Education," or "Gender Equality."

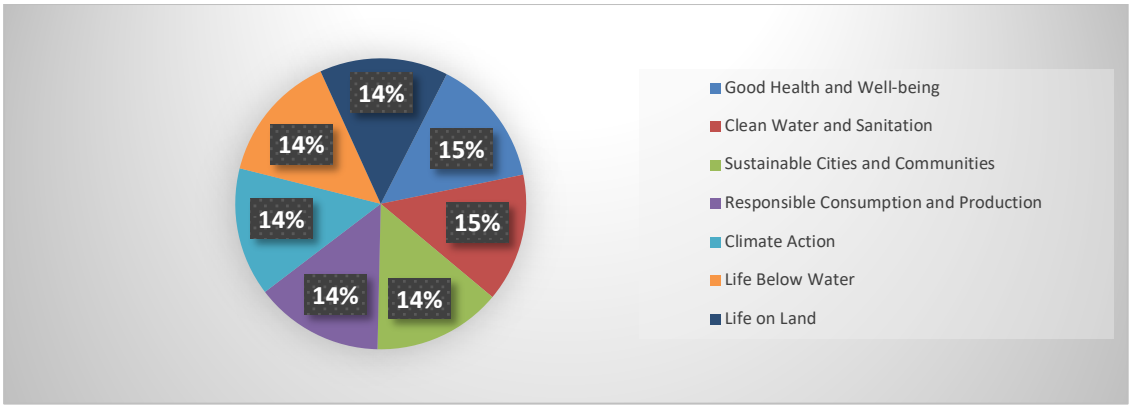

Figure 4. Proportion of SDGs Present in Learning Outcomes by Grade Level

Learning outcomes at the 6th-grade level were examined, and the results are presented in Figure 5. At this level, a total of 45 learning outcomes were found to be related to the Sustainable Development Goals (SDGs). The most frequently associated SDGs were "Life Below Water," "Climate Action," "Life on Land," and "Good Health and Well-Being." No learning outcomes were identified related to SDGs such as "No Poverty," "Zero Hunger," or "Quality Education."

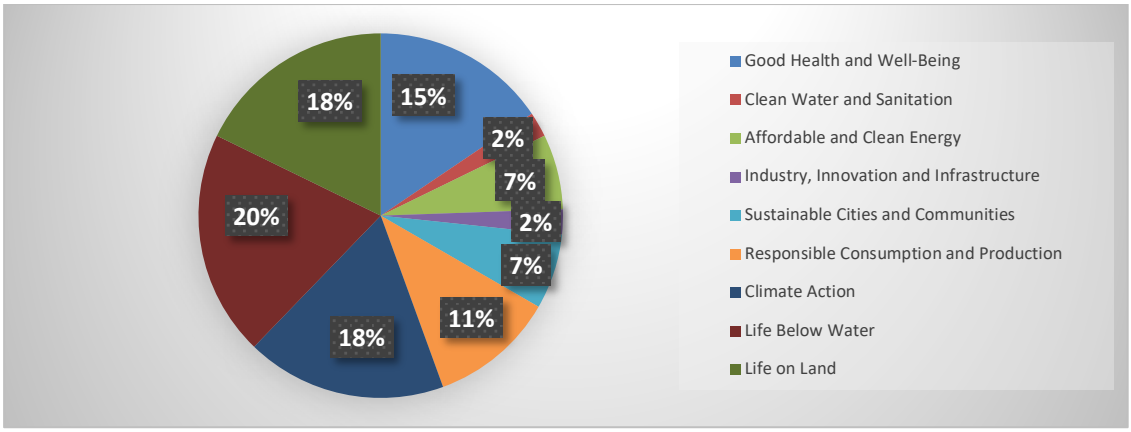

Figure 5. Proportion of SDGs Present in Learning Outcomes at the 6th Grade Level

Learning outcomes at the 7th-grade level were examined, and the results are presented in Figure 6. At this level, a total of 20 learning outcomes were found to be related to the Sustainable Development Goals (SDGs). The most frequently associated SDGs were "Good Health and Well-Being," "Climate Action," "Life Below Water," and "Life on Land." No learning outcomes were identified as related to certain SDGs at this grade level.

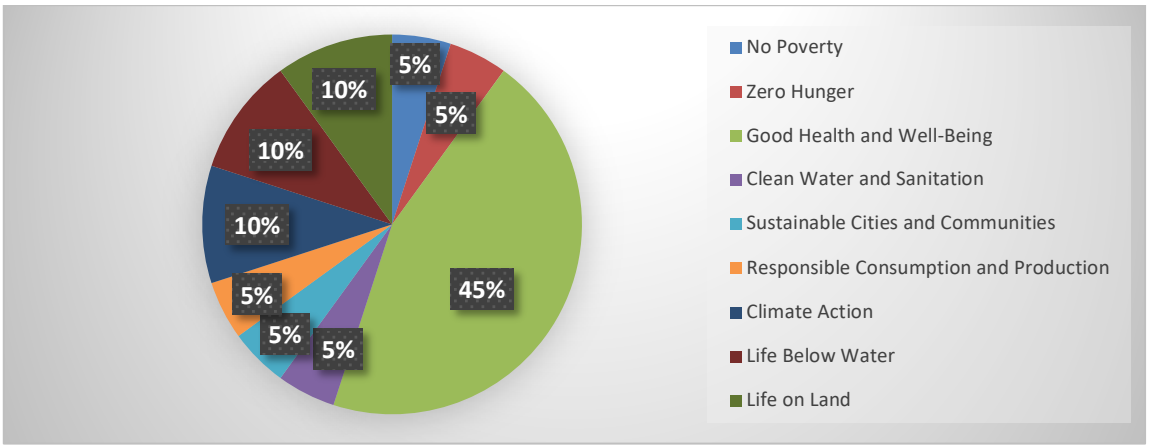

Figure 6. Proportion of SDGs Present in Learning Outcomes at the 7th Grade Level

Learning outcomes at the 8th-grade level were examined, and the results are presented in Figure 7. At this level, a total of 59 learning outcomes were found to be related to the Sustainable Development Goals (SDGs). The most frequently associated SDGs were "Climate Action," "Life Below Water," "Life on Land," and "Good Health and Well-Being." No learning outcomes were identified related to SDGs such as "Zero Hunger," "Quality Education," or "Gender Equality" at this grade level.

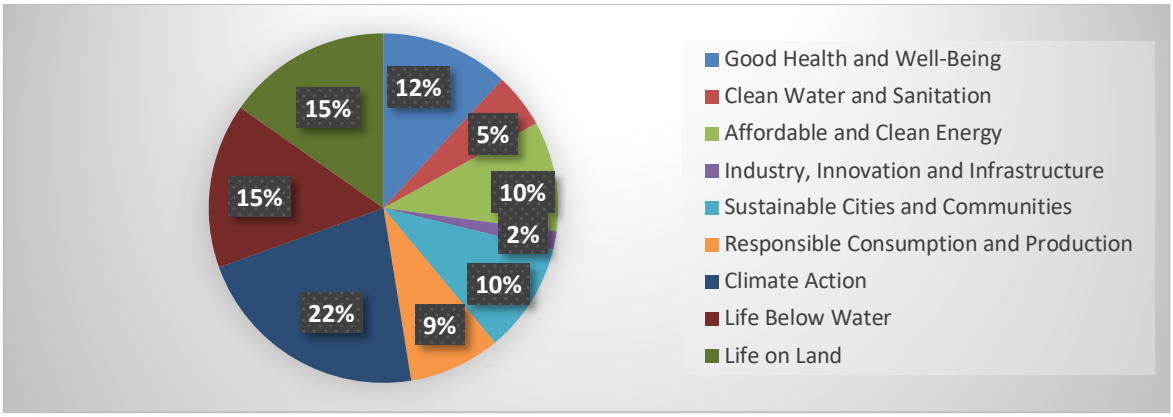

Figure 7. Proportion of SDGs Present in Learning Outcomes at the 8th Grade Level

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This section presents the conclusions derived from the research findings, followed by a discussion of these results and recommendations directed at practitioners and researchers based on the study's outcomes.

Discussion

Sustainable development represents a multidimensional, interdisciplinary, and comprehensive approach that lies at the core of contemporary educational policies. This approach aims not only to equip individuals with theoretical and scientific knowledge but also to foster sensitivity towards environmental, social, and economic issues, cultivate a sense of ethical responsibility, and develop competencies to generate solutions for these challenges. The holistic development of sustainable development–oriented skills and values within educational processes is essential for students to effectively address the complex and multifaceted problems of the 21st century. Accordingly, curricula are expected to encompass not only cognitive domains but also affective and psychomotor domains, providing multidimensional learning outcomes.

Within this study, the 2024 TYMM FBDÖP was comprehensively examined through the lens of the 17 SDGs defined by the United Nations. The analysis extended beyond the learning outcomes included in the curriculum to cover structural and functional elements such as the program's foundational philosophy, general and specific objectives, and principles of implementation.

The findings of this study offer significant insights regarding the integration level of the 2024 TYMM FBDÖP Curriculum with the SDGs. The prominence of goals such as "Quality Education" (21%), "Climate Action" (10%), and "Peace, Justice and Strong Institutions" (10%) in the specific objectives section (Table 1) indicates that science education traditionally emphasizes scientific

literacy and environmental awareness (Bybee, 2014). However, the absence of fundamental SDGs such as “No Poverty,” “Zero Hunger,” and “Gender Equality” highlights an insufficient consideration of the social dimension within the curriculum.

The analysis of the principles of implementation (Table 2) reveals a significant neglect of the SDGs. Particularly, the lack of a sustainable development perspective in teaching methods and assessment processes can be considered the curriculum’s most critical weakness in terms of implementation. This finding aligns with Demirbaş’s (2011) study and reflects a general tendency observed in Turkish curricula.

Analysis of the cross-curricular components (Tables 3–6) indicates that the virtue–value–action framework is primarily concentrated on “Peace, Justice and Strong Institutions” (14%) and environmental goals. However, the complete absence of some SDGs within the social-emotional learning and literacy sections exposes limitations regarding the curriculum’s comprehensiveness.

The analysis of learning outcomes by grade level (Tables 7–8) demonstrates a gradual increase in the presence of SDGs within the program—from 21% at the 5th grade to 44% at the 8th grade. Notably, certain SDGs, namely the 4th (Quality Education), 5th (Gender Equality), 8th (Decent Work and Economic Growth), 16th (Peace, Justice and Strong Institutions), and 17th (Partnerships for the Goals), are entirely absent across all grade levels. These findings indicate that essential dimensions of sustainable development related to social justice, equality, human rights, and global partnerships are insufficiently integrated into science education (UNESCO, 2017), suggesting gaps in addressing the social and economic pillars of sustainability within the curriculum.

Conclusion

In this study, the relationship between the 2024 TYMM FBDÖP and the 17 SDGs was systematically analyzed through document analysis. The findings reveal that the curriculum demonstrates significant integration with environmental aspects of sustainable development education. The increasing emphasis on environmental sustainability themes across grade levels suggests that the curriculum aims to establish a structured and progressive learning process.

However, the limited representation of the social and economic dimensions of sustainable development within the curriculum constitutes a critical shortcoming for achieving a comprehensive and balanced education for sustainability. Particularly, SDGs that focus on social justice and equity-such as eradicating poverty, promoting gender equality, and

fostering decent work and economic growth-are either underrepresented or entirely absent at the level of learning outcomes. This raises the risk that students may engage with sustainability only through an environmental lens.

Moreover, although the goal of "Quality Education" is prominently emphasized in the curriculum's general objectives, the absence of direct learning outcomes linked to this goal highlights a discrepancy between the theoretical framework and its practical implementation. This misalignment indicates an area in need of structural improvement to ensure coherence throughout the curriculum.

Recommendations

1. **Diversifying curriculum content:** The Science Course Curriculum should be restructured to encompass not only environmental, but also social and economic dimensions of sustainable development. Accordingly, learning outcomes explicitly addressing SDGs such as Goal 1 (No Poverty), Goal 2 (Zero Hunger), Goal 5 (Gender Equality), Goal 10 (Reduced Inequalities), and Goal 17 (Partnerships for the Goals) should be directly integrated into the program.
2. **Aligning learning outcomes with curriculum objectives:** The structural coherence between the curriculum's general objectives and its learning outcomes should be enhanced. For the emphasis on sustainable development in the curriculum's theoretical foundation to be reflected in practice, the learning outcomes must be explicitly aligned with the SDGs.
3. **Ensuring equitable distribution across grade levels:** While the inclusion of SDG-related learning outcomes increases across grade levels, some goals are entirely overlooked in lower grades. Sustainability themes should be distributed more evenly across all grade levels, taking into account developmental appropriateness.
4. **Enhancing teacher competencies:** In-service teacher training programs should incorporate comprehensive instructional strategies that address the environmental, social, and economic dimensions of sustainability. These programs should emphasize interdisciplinary approaches, values-based learning, problem-solving, and action-oriented pedagogies.
5. **Promoting experiential learning environments:** School projects, research activities, and in-class implementations should offer students hands-on opportunities to engage with the SDGs in meaningful and action-driven ways. These activities can be used to supplement curriculum areas where certain SDGs are currently underrepresented.

6. **Integrating values education with sustainability:** The values education components of science instruction should be restructured to establish stronger links with sustainability education. This approach can foster not only cognitive learning but also ethical awareness, responsibility, and social sensitivity.
7. **Establishing monitoring and evaluation systems:** Comprehensive qualitative and quantitative studies should be conducted to monitor the implementation of the curriculum. Such research would provide evidence-based insights into the effectiveness of the curriculum in promoting sustainability and support informed decision-making in policy development.
8. **Conducting longitudinal impact research:** Long-term, longitudinal research designs should be employed to track students' progress in knowledge, skills, and attitudes related to sustainable development. This would allow for an assessment of the curriculum's sustained impact on student outcomes over time.
9. **Comparative studies across disciplines:** Future studies should examine how the SDGs are addressed not only in science but also in other subject area curricula. Comparative analyses would provide insights into how sustainability is incorporated across disciplines and contribute to the development of a holistic educational approach within the national system.

REFERENCES

Alkış, N. (2009). Education for sustainable development: Theoretical and practical approaches. *Journal of Ankara University Faculty of Educational Sciences*, *42*(1), 45–62.

Ateş, M. (2019). Sustainable development in the science education curriculum. *Education and Science*, *44*(197), 269–286.

Aytar, B., & Özsevgeç, T. (2019). The importance of interdisciplinary approaches in science education. *International Journal of Educational Research*, *5*(3), 101–114.

Bencze, L., Bowen, G. M., Alsop, S., & Carter, L. (2013). Teaching sustainable development in science education: Perspectives from practice. *International Journal of Science Education*, *35*(7), 1153–1177. https://doi.org/10.1080/09500693.2011.629016

Bilgili, M. (2017). Evaluation of teachers' competencies in sustainable development. *Educational Administration: Theory and Practice*, *23*(2), 210–225.

Bailey, E. E., & Friedlaender, A. F. (1982). Market structure and multiproduct industries. *Journal of Economic Literature*, *20*(3), 1024–1048.

Çankaya, S. (2014). Awareness and attitudes of pre-service teachers towards environmental problems. *Education and Society*, *34*(124), 67–84.

Creswell, J. W. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. [Invalid source: Facebook URL is not acceptable.]

Demirer, V. (2006). *Science teaching and new approaches*. Ministry of National Education Publications.

Demirbaş, M. (2015). Awareness levels of pre-service teachers on sustainable development. *Journal of the Faculty of Education of Mehmet Akif Ersoy University*, *1*(36), 1–15.

Demirbaş, M. (2011). Implementation of sustainable development themes in social studies courses. *Journal of Social Sciences Institute*, *29*(1), 77–92.

Demir, İ., & Atasoy, B. (2021). The relationship between students' sustainability knowledge and behaviors. *Journal of Educational Research*, *28*(3), 345–360.

Dere, İ., & Çınkaya, S. (2023). Analysis of the environmental education and climate change curriculum in terms of UN 2030 sustainable development goals. *Turkish Journal of Social Research*, *27*(1), 1–20.

Gayford, C. (2001). Attitudes to science: A review. *International Journal of Science Education*, *23*(7), 711–721. https://doi.org/10.1080/09500690110033583

Gürdal, A. (1991). *Science teaching: Concept development and ways of scientific thinking*. Council of Higher Education Publications.

Johnston, B. (2011). Environmental education and sustainability: A critical review. *Environmental Education Research*, *17*(2), 243–255. https://doi.org/10.1080/13504622.2010.508633

Karasar, N. (2007). *Scientific research method*. Nobel Publishing.

Kaya, B., & Tomal, N. (2011). Education for sustainable development in the social studies curriculum. *International Eurasian Journal of Social Sciences*, *2*(5), 1–15.

Kearney, L., & Tashlik, P. (1985). Cooperation and conflict: Teachers and researchers learn. *Language Arts*, *62*(7), 765–769.

Ko, M., & Lee, W. (2003). Student attitudes toward science and technology. *Journal of Science Education*, *24*(4), 211–220.

Lourdel, N., Klein, P., & Jeannerod, R. (2005). Development of sustainability education: A case study. *Journal of Environmental Education*, *36*(4), 9–19.

Ministry of National Education [MoNE]. (2013). *Primary school science course curriculum*. Board of Education, Ankara.

Ministry of National Education [MoNE]. (2018). *Primary school science course curriculum*. Board of Education, Ankara.

Ministry of National Education [MoNE]. (2018). *Development of curricula: General information*. Board of Education, Ankara.

Ministry of National Education [MoNE]. (2024a). *Türkiye Yüzyılı Maarif Model: Common text of curricula*. Board of Education, Ankara.

Ministry of National Education [MoNE]. (2024b). *Türkiye Yüzyılı Maarif Model science course curriculum*. Board of Education, Ankara.

Ministry of National Education [MoNE]. (2024). *2024–2028 Strategic Plan*. Ministry of National Education.

Ministry of National Education [MoNE]. (2024). *Türkiye Yüzyılı Maarif Model introductory booklet*. MEB Publications. https://mufredat.meb.gov.tr/

Ministry of National Education [MoNE]. (2024). *Science curriculum for secondary school (Grades 5–8)*. Board of Education. https://mufredat.meb.gov.tr/

McKeown, R., & Hopkins, C. (2007). Education for sustainable development: The global perspective. *Journal of Education for Sustainable Development*, *1*(1), 12–20.

Özgür, E. (2020). Analysis of sustainability themes in the science curriculum. *Theory and Practice in Education*, *16*(3), 420–435.

Öztürk, H. Y. (2016). *The mediating role of functional capabilities in the effect of learning orientation on firm performance and the moderating effect of competition intensity* [Master's thesis, Yıldız Technical University]. National Thesis Center of the Council of Higher Education. https://tez.yok.gov.tr/

Pauw, I., Kleinbooi, K., & Botha, E. (2015). Integration of sustainability education in science curricula. *International Journal of Sustainability in Higher Education*, *16*(4), 441–456. https://doi.org/10.1108/IJSHE-12-2013-0126

Pope, J., Annandale, D., & Morrison-Saunders, A. (2004). Conceptualising sustainability assessment. *Environmental Impact Assessment Review*, *24*(6), 595–616.

Şüheda, N., & Akçay, B. (2021). Teachers' sustainability awareness and classroom practices. *Journal of Qualitative Research in Education*, *9*(2), 180–197.

UNESCO. (2014). *Education for sustainable development: Sourcebook*. Paris: UNESCO.

United Nations Development Programme (UNDP). (2020). *Sustainable development goals report 2020*. UNDP. https://sdgs.un.org/publications

World Commission on Environment and Development [WCED]. (1987). *Our common future*. Oxford University Press.

Worster, D. (1993). *Nature's economy: A history of ecological ideas*. Cambridge University Press.

Yıldırım, A., & Şimşek, H. (2016). *Qualitative research methods in social sciences* (10th ed.). Seçkin Publishing.

Yıldırım, A., & Şimşek, H. (2021). *Qualitative research methods* (12th ed.). Seçkin Publishing.