Science Education Reform 2.0 in Egypt: How the Concepts of the United Nations Sustainable Development Goals 2030 Were Integrated into Primary Science Curricula

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ABSTRACT

The Ministry of Education launched Egypt's vision for reforming education in what is known as Education 2.0, and the process of developing educational curricula was at the heart of this vision, given the modern content of the Science 2.0 curricula; This required analysis to determine the extent to which it has achieved tangible reform in one of the global requirements targeted by the United Nations, which is the Sustainable Development Goals 2030 (SDGS 2030), as it called for these goals to be the focus of education to protect the planet and the rights of future generations. Therefore, this study aimed to present A list of scientific concepts and topics related to the SDGS 2030 that can be integrated into Science Education 2.0 curricula at the primary stage, and then identify the extent to which Science Education 2.0 curricula for grades (fourth - fifth - sixth) at the primary stage in Egypt include those concepts and topics. Then, recommendations were made for how to incorporate these concepts into the Science 2.0 curricula. The study followed the descriptive approach using the content analysis method. The study found that the degree to which the Science 2.0 curricula included the concepts of SDGS2030 was generally moderate, as their frequency in the fourth-grade books reached 77 concepts, at a rate of 32.6%, and in the fifth-grade books, 83 concepts found, at a rate of 35.16%, and in the sixth-grade books, 126 concepts found at a rate of 53.3%, The results also showed that Science 2.0 curricula addressed 12 SDGs, while they did not address five goals: poverty eradication, gender equality, reducing inequalities, peace, justice, and strong institutions, and partnerships to achieve the goals. Finally, the study suggested considering its findings, recommendations are made for how to include concepts and topics of SDGS2030 in Science 2.0 curricula that are not addressed in current curricula.

Introduction

Sustainable development issues and problems are among the most important issues currently preoccupying the world because they have major impacts on humans and society, and even on the entire planet. For society to be able to confront these problems and evaluate solutions, this must be done through education. So, education is a major component of improving the human condition, and the focus is on preparing the next generation to make

informed decisions that help them achieve a more sustainable life.

Sustainable development is the process of transforming society in all its behaviors and actions, and this matter does not happen by law or by changing the constitution. Since development cannot take place unless there are enlightened individuals who know what they want? They work to disseminate this knowledge in their society. Sustainability in the development process aims to secure capabilities, energies, and resources for future generations that have not yet been born, with the same efficiency currently available. Sustainability, in its essence, is justice in equal opportunities between the different social segments of the present generation and between it and subsequent generations (Al-Kurd, 2018).

Sustainable development is defined as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Sustainable development calls for concerted efforts to build a future for people and the planet that is inclusive, sustainable, and resilient. To achieve sustainable development, three basic elements must be reconciled: economic growth, social inclusion, and environmental protection. These elements are interconnected and crucial to the well-being of individuals and communities (United Nations, 2015).

The member states of the United Nations have agreed to establish a team to develop a set of goals that represent the core of the sustainable development plan. In 2015, the United Nations adopted the SDGs, which are also known as the Global Goals, as a global call to action to end poverty protect the planet and ensure that all people enjoy peace and prosperity by 2030. The SDGs are integrated, that is, they recognize that action in one area will affect outcomes in others, and that development must balance social, economic, and environmental sustainability by pledging to leave no one behind at the back. This is why the SDGs are designed to make the world turn to zero in many life-changing aspects, including poverty, hunger, and discrimination against women. These goals promise the peoples of the world to spread songs of peace and omens

of prosperity to all corners of the globe. They also represent - Collectively - an urgent call to action. Therefore, all citizens of the world should pay attention to it before it is too late (Development Program in Arab States, 2022).

Based on the goals set by the United Nations to achieve sustainable development, we find that there is a need to redesign education in terms of sustainability, meaning changing the curriculum that enhances understanding of the SDGs, by integrating the concepts of sustainability and its components into the curriculum across all different educational stages, starting from kindergarten through university education.

There is a need for a more enlightened learner who has an awareness of the challenges and solutions of sustainability, and the ability to express concern for meeting people's needs, intergenerational equity, caring for the world's poor, helping the Earth's regenerative capacities and for pointing out the ecological relationships that exist between humans and the environment around them. (Kates, et, al, 2001). Therefore, education programs must respond to this call and work to achieve a greater vision of preparing learners both as citizens and as future leaders, as studying problems and solutions related to sustainability is an imperative necessity to confront them (United Nations Education, Scientific, and Cultural Organization, 2004).

Background and Purpose

1- United Nations Sustainable Development Goals 2030 (SDGs)

The Sustainable Development Goals are a global call to all poor, rich, and middle-income countries to work to eradicate poverty, protect the planet, and ensure that all people enjoy peace and prosperity. These goals recognize that eradicating poverty must go hand in hand with strategies that build economic growth. It also addresses a range of social needs including education, health, social protection, and employment opportunities while addressing climate change and environmental protection (United Nations, 2015).

These seventeen goals are based on the successes achieved in achieving the Millennium

Development Goals (2000-2015), and aim to achieve the appropriate amount of well-being for current generations in an integrated and comprehensive manner that extends to future generations (United Nations, 2015). These goals are:

1. Eliminate poverty in all its forms everywhere.
2. Eliminate hunger, provide food security and improved nutrition, and promote sustainable agriculture.
3. Ensure that everyone enjoys healthy lives and well-being at all ages.
4. Ensuring equitable and inclusive quality education for all and promoting lifelong learning opportunities for all.
5. Achieving gender equality and empowerment for all women and girls.
6. Ensuring the availability of water and sanitation services for all and their sustainable management.
7. Ensure universal access to affordable, reliable and sustainable modern energy services.
8. Promoting sustained, inclusive and sustainable economic growth, full and productive employment, and providing decent work for all.
9. Build resilient infrastructure, stimulate inclusive industrialization, and encourage innovation.
10. Reducing variation within and between countries.
11. Make cities and human settlements inclusive, safe, resilient and sustainable.
12. Ensuring sustainable consumption and production patterns.
13. Take urgent action to address climate change and its impacts (taking note of the agreements concluded by the UNFCCC Forum).
14. Preserve the oceans, seas, and marine resources and use them sustainably to achieve sustainable development.
15. Protect and restore terrestrial ecosystems and promote their sustainable use, sustainably manage forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss.
16. Encouraging the establishment of peaceful societies in which no one is marginalized to achieve sustainable development, providing everyone with access to justice, and building effective, accountable, and inclusive institutions at all levels.
17. Strengthening the means of distinguished global partnership between all bodies and entities to achieve sustainable development.

The sustainable development strategy "Egypt Vision 2030" represents the basis of the comprehensive development process in Egypt that links the present with the future, to build a development process for an advanced and prosperous nation in which economic and social justice prevails. The strategy adopted the concept of sustainable development as a general framework intended to improve the quality of life at present without prejudice to human rights so future generations will live a better life, and therefore the concept of development adopted by the strategy is based on three main dimensions, including the economic dimension, the social dimension, and the environmental dimension. The strategy is also based on the concepts of "inclusive and sustainable growth and balanced regional development," which emphasizes everyone's participation in the construction and development process (Presidency of the Egyptian Council of Ministers, 2019).

Education for sustainability is one of the most important factors that contribute to achieving the United Nations goals for sustainable development, as the Quality Assurance Authority for Higher Education in the United Kingdom defined it as the process of providing learners with the knowledge, skills, and qualities required for work and life in a way that protects the environmental, social and economic interests of both current and future generations (Quality Assurance Agency for Higher Education, 2021)

This requires a well-prepared teacher who is aware of the sustainable development goals. A study (Paz & Locatelli, 2023) confirmed that primary school science teachers in Brazil find it difficult to integrate sustainable development goals into science education and that they need

training on how to integrate them into the curriculum. In a study (Tribble, et al, 2022), an effective method was proposed to make science relevant to students, enhance their awareness of sustainability, and encourage them to take action to help the global community achieve the goals of sustainable development, and the study (Al-Baz, 2019) confirmed that pre-service science teachers They do not study the Sustainable Development Goals within their preparation program at the university and I provided a program for science teachers on the Sustainable Development Goals to develop their sustainable thinking.

2-Science Education Curricula 2.0 in the New Education

The Ministry of Education launched Egypt's reform vision for developing education, and the curriculum development process was at the heart of this vision. The signal to begin implementing this vision began with the first and second grades of kindergarten in 2018 and will continue until the end of the secondary stage. This vision aimed to make major transformations in the teaching and learning processes, moving from acquiring knowledge to producing it, and from learning skills to employing them in learning situations and disseminating them in the learner's life outside the classroom. It also included curricula of the values that build Egyptian society, which is a fence that protects the nation. The vision also targeted reformist Egypt to develop curricula that considered the specifications of the pre-university education graduate and the challenges that Egypt faces locally, regionally, and globally, as the developed curricula targeted building a citizen capable of cultural communication and building a positive dialogue with others, as well as acquiring digital citizenship skills (Egyptian Ministry of Education, 2024).

Education System 2.0 is defined as "a modern term that refers to a redefinition of the roles of both teachers and learners in light of advances in information and communication technology, where learners assume more active roles as contributors to course content while displaying learning outcomes through their

performance and production of ideas" (Nassar, 2017). The Education System 2.0 aims to promote a vision of "learning, thinking and innovation", in which education constitutes a means that leads to the presence of learners who have a passion for learning and knowledge, and are communicative, open-minded, innovative and creative who can compete in national and international markets and to contribute to the creation of a "learning society", as well as to achieving development. Economic and social issues in Egypt (UNICEF, 2018).

The philosophy of the new education system 2.0 stipulates providing education to all with high quality and without discrimination. The framework philosophy consists of several aspects: enhancing life skills, focusing on entrepreneurship skills, promoting positive values, comprehensive growth of the learner, focusing on critical thinking skills, and mastering learning skills. Self-paced and continuous, and a balance between knowledge assessment and integration of technology into the curriculum (Ghannam, 2019).

The Egyptian Ministry of Education relied on the Center for Curriculum and Educational Materials Development to develop a general framework for the new education curricula, which included three main components: skills, issues, and values. Regarding skills, the twenty-first-century life skills approved by UNICEF were adopted, which consist of twelve life skills: creativity, critical thinking, problem-solving, cooperation, negotiation, decision-making, self-management, resilience, communication, respect for diversity, empathy, and participation. Two skills were added to it: transparency and accountability, due to the Egyptian society's need for them. As for local and global issues, a list of approximately eighty issues was made, which was then classified into five main issues: environment and development, health and population, non-discrimination, citizenship, and globalization. It was included within the new system's curricula. As for values, a matrix of values has been developed that reflects Egyptian national culture and the prospects for its future development (Dawoud, 2021).

The general framework for the Education

System 2.0 curricula was designed. International companies specialized in building curriculum content, known for their quality and efficiency, such as Discovery, National, Nahdet Misr, York Press, and Britannica, were used to produce curricula appropriate to the academic grades. As for the Science Education 2.0 curricula, the curricula were built through the Curriculum and Educational Materials Development Center in cooperation with the Discovery Educational Foundation, which is a leading American institution for building educational curricula. Its construction considered the culture of Egyptian society, in addition to the points regarding the curricula in general, science curricula have focused on Next Generation Science Education Standards (NGSS), engineering design, and STEM education activities, which are the most important modern trends in science education in the current age.

Many studies have been interested in revealing the reality of science curricula in different countries including the dimensions of sustainable development -environmental dimension, social dimension, and economic dimension-, (Shahda, 2017; Abdul Rab and Al Ashmouri, 2020; Al Kahaliya and Shahat, 2021; Almutairi and Hajj Omar, 2022; Tribble, et al, 2022; Suwaidan and Al-Asali, 2023; Abdel-Ghafer and Al-Shalabi, 2023), but these studies focused on analyzing science curricula in light of the dimensions of sustainable development and not in light of the seventeen international goals, and the Egyptian studies analyzed the ancient science curricula in the education 1.0. Therefore, anyone looking to develop science curricula 2.0 finds it necessary to analyze them to find out how to reform science education, and how to integrate SDGs2030 into the curricula, which is what the current study seeks. From here, the problem of the study can be defined by the following questions:

1. *What concepts of SDGs2030 should be included in science education 2.0 curricula in Egypt?*
2. *To what degree are the concepts of SDGs2030 included in science education 2.0 curricula in Egypt?*

3. *What are the proposed recommendations considering the results of the study to include the concepts of SDGs2030 in science education 2.0 curricula in Egypt?*

Methodology:

The researcher used the descriptive analytical method, which is based mainly on the content analysis method due to its suitability to the purpose of the study. It is "a research method applied to reach a purposeful and organized quantitative description of the content of the communication style and is based on quantitative analysis of the chosen unit of analysis to know the amount or size of the phenomenon, and arriving at conclusions that help develop the content or reality that you are studying (Tamiya, 2004).

Study Sample:

The researcher chose Science Curricula 2.0 for the primary stage in Egypt as a model for researching the degree to which the concepts of SDGs2030 are included in these curricula. Due to the importance of including these goals in academic curricula in general and science curricula in particular, the context of the science content allows for addressing the concepts of sustainable development in a logical and integrated method.

Procedures

First: Prepare a list of concepts of SDGs2030 that must be present in the science curriculum for the primary stage:

1- Review SDGs2030 and derive the scientific concepts they contain.
2- Review international projects, experiences, and previous foreign and Arab studies concerned with evaluating and developing science education 2.0 curricula considering the sustainable development goals.
3- The list of concepts was presented in its initial form to a group of reviewers specialized in curricula and science teaching methods. The reviewers recognized the importance of the concepts in the list, making some amendments based on the reviewers' opinions and suggestions.

4- Preparing the final version of the Sustainable Development Goals 2030 concept list. It included (17) main goals. Each goal may include several concepts and topics, amounting to (236) scientific concepts and topics included in it, as well as several applied practices that should be acquired by learners through studying the goal of sustainable development, which is distributed as follows:

Table 1. List of concepts of SDGs2030 that must be present in science 2.0 curricula for the primary stage

N	SDGs	Concepts and Topics of SDGs2030	Practices of SDGs2030
1	**No Poverty**	Poverty - types of poverty (audited poverty - relative poverty) - the impact of poverty on the lack of basic human needs (clothing, food, shelter, health) - the impact of natural resource consumption on poverty - the importance of agriculture in combating poverty - sustainable energy and reducing poverty - ways to combat poverty - Diseases associated with poverty (malaria, cholera, tuberculosis) - Energy sources in poor communities - The relationship between malnutrition (hunger) and poverty - Waste management in poor communities - The impact of natural disasters on poor areas	Sustainable dealing practices with needy students in class, school and residence.
2	**Zero Hunger**	Hunger - the main nutritional components (carbohydrates - proteins - fats - vitamins and minerals) - balanced diet - food production - food chains - crop improvement techniques - sustainable agriculture to provide food - food security - economic factors affecting food security - the role of biological and agricultural diversity in Food security - malnutrition and its types - causes of malnutrition - how it affects health - diseases related to hunger (thinness - anemia - anemia - stunting - nutritional deficiency).	Practices to reduce food waste and provide food to others in the classroom, school, and residence.
3	**Good Health and Well-being**	Health - Infectious diseases - Their causes - Methods of transmission - Prevention - Vaccinations - The importance of vaccines - Personal hygiene to prevent diseases - Mental health and ways to maintain it - Reducing stress, anxiety, and fear - Physical health - Physical activities - Benefits of exercising - Reproductive health - Adulthood- Maintaining health in adulthood - global health challenges - global epidemic diseases - the Corona crisis - the role of international organizations in improving global health.	Health maintenance practices, healthy habits, and disease prevention
4	**Quality Education**	Science - the nature of science - the importance of teaching science - the basic science processes for achieving scientific knowledge - the scientific method - sources for learning science - conducting laboratory and virtual experiments - sources for searching for information - models of scientists and their scientific innovations - the impact of education and science on humanity - the impact of science and technology on society – Teaching engineering design skills – designing and producing scientific models – teaching different thinking skills (scientific, critical and creative) – applying scientific knowledge to solve environmental and health problems – designing scientific projects.	Scientific curiosity practices Searching for sources of information and designing scientific projects
5	**Gender Equality**	The concept of male and female in humans - Physiological differences between the sexes in humans - Differences in size, weight, and body shape - The effect of biological differences on health - Health awareness specific to each sex - The concept of gender equality in rights (education - work) - Forms of discrimination against girls - The health harms of violence against girls - the crime of female circumcision - examples of male and female scientists who have a prominent role in the development of science (Marie Curie - Rosalind Franklin - Alan Turing).	Practices of equality between boys and girls at the grade, school, and residential levels, and avoiding violence against girls

N	SDGs	Concepts and Topics of SDGs2030	Practices of SDGs2030
6	Clean Water and Sanitation	Water-Water composition - Physical and chemical properties of water - The importance of water as a vital resource - The water cycle in nature - Change in water conditions - Preservation of water resources - sanitation- Water pollutants and their sources - The effect of pollution on water - Preventive measures to maintain clean water - Clean water for future generations - Equity in water distribution - The importance of clean water for public health - Waterborne diseases - Hygiene - Hygiene practices at home, school and public places - Waste - its types and methods of disposal.	Practices to conserve water resources and maintain personal hygiene
7	Affordable and Clean Energy	The concept of energy - forms of energy - energy transformations - fossil energy - its harmful impact on the environment - clean energy - renewable energy sources - solar energy - water energy - wind energy - energy saving techniques - clean technology - energy saving lamps - electric cars - benefits of electric cars for the environment - state legislation for the use of clean energy.	Practices to reduce energy consumption, save energy, and replace it with energy that is clean for the environment
8	Decent work and Economic Growth	The role of science in the advancement of society - Jobs and professions related to science (doctor - engineer - scientist - farmer - veterinarian - chemist...) - Jobs in STEM applications - The importance of work for humans - Health harms of not getting work - Skills needed for work (communication - listening - cooperation - responsibility - leadership - motivation - management - negotiation - problem-solving - decision making - innovation - presenting new ideas..) - producing models used in the field of work - entrepreneurship skills - creating creative ideas.	Entrepreneurship practices for scientific projects (production of simplified scientific devices - production and cultivation of plants...)
9	Industry, Innovation, and Infrastructure	The relationship between science and technology - the concept of industry - the role of science and technology in developing industry - the most important industries based on (matter - animals - plants) - scientific innovations to improve industry - the environmental impact of industry - environmentally friendly industries - waste treatment industry - infrastructure - movement and its relationship to building Roads, bridges, airports, and ports in movement and transportation - The importance of infrastructure (water, electricity, gas, communications) in the well-being of society - How to maintain the infrastructure.	Public utility conservation practices - production of simplified industrial technological models (miniature robot, compass, electromagnet..)
10	Reducing Inequalities	Human nature - stages of human life - man and his sensory organs - the concept of disability - types of disabilities that affect humans - health needs of the disabled according to his disability - discrimination between people based on disability - harms of discrimination between people.	Practices of dealing equally with integration students with special needs in the classroom, school, and residence
11	Sustainable Cities and Communities	The concept of shelter for living organisms - housing for humans - conditions for suitable housing for humans - healthy green homes - green buildings - sustainable cities - preserving natural heritage in cities - protecting biodiversity - natural disasters (earthquakes, volcanoes, floods) - confronting disasters through city planning - Sustainable transportation - safe roads - the importance of plants and green spaces in cities - green classroom - green school.	Learners' practices to achieve a sustainable green classroom, a sustainable green school and a sustainable green home

N	SDGs	Concepts and Topics of SDGs2030	Practices of SDGs2030
12	Responsible Consumption and Production	Natural resources - types of natural resources - sustainable use of resources - reducing waste - the cycle of life thought (product life cycle) - sustainable consumption patterns - sustainable purchasing - food waste - reducing plastic use - creating recycling models - reducing consumption	Learners' practices in production and thinking about the product life cycle.
13	Climate Action	Climate and weather - the carbon cycle in nature - climate change - global warming - sources of carbon emissions - carbon footprint - greenhouse gases - natural and human factors associated with climate change - climate impacts (sea level rise - global temperature rise - weather phenomena Harsh) - The impact of climate change on ecosystems and biodiversity - How to adapt to climate change - Ways to mitigate climate change - Experimenting with the effect of carbon dioxide on the temperature of a closed environment.	Practices to Reduce Emissions that cause climate change
14	Life Blow Water	Water as an ecosystem - the difference between seas, oceans and rivers as ecosystems - water pollution and its causes - natural and human sources of water pollution - protecting aquatic ecosystems (biodiversity in water - coral reefs - wetlands - aquatic plants..) - blue economy - sustainable fishing - Sustainable marine tourism - aquaculture - aquatic renewable energy - sustainable maritime transport - marine mining - marine protected areas around the world - ocean acidification - addressing ocean acidification - aquatic waste management.	Practices for preserving and protecting water bodies and their living organisms
15	Life on Land	Terrestrial ecosystems - mountains and forests as terrestrial ecosystems - protection of natural habitats - local and global nature reserves - adaptation of organisms to the ecosystem - reforestation - desertification - its causes - ways to combat it - adaptation to desertification - loss of biodiversity - extinction - preservation of species - Genetic diversity - invasive species of plants and animals - combating invasive species - sustainable agriculture.	Practices for preserving and protecting wild ecosystems and their living organisms
16	Peace, Justice and Strong Institutions	School science laboratory - The importance of the laboratory and studying in it - Laboratory safety - Safety instructions in the school laboratory - Avoiding conflict and violence - Safely using tools and materials - First aid for experimental injuries - Fair distribution of materials and tools - Sustainable use of laboratory materials and tools - Laboratory and instrument maintenance practices for the sake of future generations.	Safety and security practices in the school laboratory and the school as a strong educational institution
17	Partnerships for the Goals	The concept of partnership - partnership between learners - partnership at the different grade levels - multidisciplinary activities in the school - community partnership - social responsibility - volunteer work - school initiatives with the local community to implement sustainable initiatives such as: planting green areas, and recycling wastes.	Teamwork and cooperation practices are represented in school and community partnerships for sustainable initiatives to protect future generations

Thus, the first question of the study has been answered, which is: "What concepts of SDG$_S$2030 should be included in science education 2.0 curricula in Egypt?"

Second: Analysis of the content of Science Education 2.0 books for the primary stage considering the list of concepts of SDG$_S$2030:

Since one of the objectives of the current study is to know the availability of the concepts of SDG$_S$2030, the content of science 2.0 books for the primary stage was analyzed, and the analysis process went through the following steps:

1- Determining the goal of the analysis: The analysis process aimed to judge the extent to which scientific content and scientific projects are included in science books for the primary stage considering the concepts of SDG$_S$2030.

2- Preparing the analysis tool: a list of concepts for SDG$_S$2030.

3- Determine the analysis sample: science books for grades (fourth - fifth - sixth) for the first and second semesters of the academic year 2023/2024 AD, from the primary stage. The following table shows the specifications of the science books that were analyzed:

Table 2. Specifications of primary school science books that were analyzed

Grade Book	Semester	Pages	Lessons	Units	Projects
Fourth	First	127	25	2	3
	Second	111	28	2	3
Fifth	First	129	27	2	3
	Second	104	21	2	3
Sixth	First	139	30	2	3
	Second	96	15	2	3
Total		706	146	12	18

4- Defining the categories of analysis: The categories of analysis were represented in the concepts of SDG$_S$2030, which number (17) goals and include (236) scientific concepts and topics included in them.

5- Defining the units of analysis: The "Idea" unit, which carries content related to the concepts and topics of SDG$_S$2030, was used as a unit of analysis. The units of analysis varied, so the concept was used as a unit to analyze the concepts contained in the units and lessons, the paragraph as a unit to analyze the content of scientific content topics, and the project as a unit to analyze projects included in science books for the primary stage.

6- Determine the unit of measurement or counting: Use (frequency) as a unit to count the appearance of each concept/topic of the concepts specified in the list; Whether directly or indirectly (implicitly).

7- Analysis controls:

1- The extent to which science curricula address the concepts was determined when the content paragraphs, scientific activities, and practical projects made any reference to any concept or topic mentioned in the list.

– Exclude pages containing the cover, introduction, and index, exclude figures and illustrations.

8- Objectivity of the analysis: To know the objectivity of the analysis, validity, and reliability were determined as follows:

A- Validity of the analysis: The analysis tool, sample, units, analysis controls, and results of analyzing the content of two units of the science book were presented to a group of reviewers to ensure the validity of the analysis and express an opinion about it. The amendments suggested by the reviewers were made.

B- Reliability of the analysis: Two units of the content of the science book for the fourth grade were analyzed for the first semester and re-analyzed again with a time difference of four weeks. The Holsti equation (Taima, 2004) was used to calculate the percentage of agreement between the two times, and it was found to be equal to (0.86), which is a percentage high reliable agreement in the study.

Results and Discussion

To answer the second question: "To what degree are the concepts of SDG$_S$2030 included in science education 2.0 curricula in Egypt? Frequencies and percentages were used; The following results were reached:

Table 3. The content analysis of the science books for the fourth grade

Unit	Concepts	Concepts and topics of SDG$_S$2030 included in the lesson	Related goals	Repetition
Living Systems	Adapt and survive	Adaptation to environmental conditions in wildlife - protecting biodiversity - the role of some animals in maintaining the ecosystem - pollution - extinction - survival - maintaining the health of the digestive and respiratory systems - human impact on the environment - clean water - saving and protecting amphibians - Maintaining waterways - maintaining clean air - the job of the amphibian conservationist	Goal 3: Good Health and Well-being Goal 6: Clean Water and Sanitation Goal 8: Decent work and Economic Growth Goal 15: Life on land	13
	How do the senses work?	Animal communication systems - technology inspired by nature (the blind's crutch is inspired by the bat's adaptation of echolocation)	Goal 9: Industry, innovation and infrastructure	2
	Light and the sense of sight	-		-
	An interdisciplinary project	Wildlife protection – human impact on other living	Goal 15: Life on land	2
Movement	Movement and stopping	Energy to move objects - types of transportation (trucks and planes)	Goal 9: Industry, innovation and infrastructure	2
	Energy and motion	Energy - energy transmission - energy forms - batteries - ion light bulbs	Goal 7: Affordable and Clean Energy	5
	Energy and collision	Car collisions and damage - seat belt and staying safe in traffic congested areas	Goal 9: Industry, innovation and infrastructure	2
	Unity project	Vehicle Safety: Designing a Safety Device in Cars - Crash Safety Precautions	Goal 4: Quality education Goal 9: Industry, Innovation and Infrastructure	2
	Safety in Science Classrooms	Protective clothing - gloves - accident preparedness - safety behavior - goggles	Goal 16: Good health and well-being	5
Energy and Fuel	Appliances and power	The role of energy in helping humans do everything - fuel - types of fuel - energy in devices around us - energy consumed and energy produced in each device - energy forms series	Goal 7: Affordable and Clean Energy	6
	About fuel	Fuel - fossil fuels - composition of fossil fuels - non-renewable energy sources - pollution - energy production - the impact of the use of fuel and energy on the environment - energy conservation - life without electricity -	Goal 7: Affordable and Clean Energy Goal 13: Climate Action	17

Unit	Concepts	Concepts and topics of SDGs2030 included in the lesson	Related goals	Repetition
		fossil fuel power plant - environmental problems in major cities - pollution - smog - Acid rain - global warming - carbon dioxide emissions - conservation of fossil fuels		
	Renewable energy sources	Renewable and non-renewable resources - Renewable energy from the sun, wind, and water - The impact of the use of renewable and non-renewable resources on the environment - Solar panels for streetlights in cities - Taking advantage of the wind - Falling water - Wind and water mills - Designing a turbine generator	Goal 4: Quality Education Goal 7: Affordable and Clean Energy	8
	Interdisciplinary project	3 (based on engineering design): Impact of deforestation - Using the sun as an energy source - Designing a solar stove Objective	Goal 4: Good Education Goal 7: Affordable and Clean Energy	3
	Unity project	Water as an energy source - turbines - clean energy - dams changing surface features - flooding the habitat of endangered species of organisms - changing fish migration paths	Goal 14: Life Below water	6
Moving Surfaces	Rocks crumble	_	-	
	Change in surface appearance	Natural disasters - floods - hurricanes - landslides	Goal 11: Sustainable Cities and Communities	4
	Unity project	The forces that shape the Eart		
Total Repetitions				77
Percentage				32.6%

Table 4. The content analysis of the science books for the fifth grade

Unit	Concepts	Concepts and topics of SDGs2030 included in the lesson	Related goals	Repetition
Nutritional Relationships between Organisms	Plant needs	The human body needs daily water and food to remain healthy and healthy - survival - natural resources - preparing for agriculture - plant needs - the difference between animals and plants - germination - comparing human and plant body systems	Goal 3: Good Health and Well-being Goal 15: Life on Land	9
	Energy transfer in the ecosystem	Consumer organisms - predators - decomposers - ecosystem - food chain - scavenger organisms (nature's scavengers) - food web - the impact of the safety and health of each type of organism in an ecosystem on the health of the entire ecological community - food as a source of energy - energy as a source of life	Goal 2: Zero Hunger Goal 3: Good Health and Well-being	10
	STEM activity	Environmental science jobs - Dr. Barak is an ecologist who specializes in ecosystems - the scientist's job is to restore damaged natural environments	Goal 4: Quality Education Goal 8: Decent work and Economic Growth	1
	Changes in food webs	Climate - preserving the environment - loss of the natural habitat - restoration of the ecosystem - pollution with plastic particles - dry lakes - changing food webs according to the change in the ecosystem - climate change - changes in the group of living organisms - coral reefs as an ecosystem - bleaching of coral reefs due to rising temperatures - Healthy habitats for living organisms - a nursery for caring for coral reefs - reducing the use of single-use plastic	Goal 13: Climate Action Goal 12: Responsible Consumption and Production Goal 14: Life Blow Water	14
	Interdisciplinary project	Treating waste: To address the problem of plastic pollution – recycling.	Goal 4: Quality Education Goal 12: Responsible Consumption and Production	2
	Unity project	Design a mini-ecosystem with decomposers, consumers and producers in an aquatic ecosystem - an ecosystem on land	Goal 14: Life Below water Goal 15: Life on land Goal 4: Quality education	2
Particle Movement	Matter in the world around us	-	-	-
	STEM activity	Professions and States of Matter - Chef and Scientist - The chef uses science to help prepare delicious and innovative dishes - Planning an innovative meal using the three states of matter	Goal 2: Zero Hunger Goal 8: Decent work and Economic Growth	2
	Description and measurement of matter	Laying roofs for homes according to climate types - Roofs according to climatic conditions (desert - cold - tropical)	Goal 11: Sustainable Cities and Communities	1
	Compare changes in matter	-	-	-

Unit	Concepts	Concepts and topics of SDGs2030 included in the lesson	Related goals	Repetition
	STEM activity	Non-potable water - water desalination - the problem of converting salt water to fresh water requires a lot of energy and is expensive - the harmful effects of seawater desalination on living organisms	Goal 6: Clean Water and Sanitation	4
	Unity project	Slippery sand	-	-
Natural Resources on Earth's Surface	Interactions between the biosphere and the hydrosphere	Water uses - Water sources - Water saving - Protection of the natural resource Water - Water conservation solutions - Wastewater treatment - Earth systems (covers) Atmosphere - Lithosphere - Biosphere - Hydrosphere - Fresh water - Salt water - Ecosystems- Biome - Groundwater - The importance of water for life on Earth - Renewable resources	Goal 6: Clean Water and Sanitation Goal 15: Life on Land Goal 14: Life Blow Water	17
	Water is the most important natural resource on Earth	A natural resource - the importance of water - protecting resources - wastewater - scarcity of resources - water bodies - how are watersheds affected if any change occurs near one of the tributaries of the Nile River (building a factory - building a dam - establishing a farm - waste depot) - preserving resources - Renewability does not necessarily mean sustainability - sustainability - practicing sustainable use - the amount of water used by humans - water filter - clean water	Goal 6: Clean Water and Sanitation Goal 15: Life on Land Goal 14: Life Blow Water	14
	STEM activity:	Wastewater Treatment Engineers - Water Recycling	Goal 6: Clean Water and Sanitation Goal 8: Decent work and Economic Growth	2
	Unity project	Living Next to Water Sources Project: Design a model of a watershed and simulate how it is exposed to pollution - Water Quality	Goal 4: Quality education Goal 6: Clean Water and Sanitation	2
	Interdisciplinary project	Seawater desalination – solar still design	Goal 4: Quality education Goal 6: Clean Water and Sanitation	2
Patterns in the Sky	Gravity effect	-	-	-
	Patterns of movement of objects in the sky	-	-	-
	Unity project	Sundial design	Goal 4: Quality education	1
Total Repetitions				83
Percentage				35.16%

Table 5. The content analysis of the science books for the sixth grade

Unit	Concepts	Concepts and topics of SDGs2030 included in the lesson	Related goals	Repetition
What system?	The cell as a system	The needs of the cell - intellectual honesty - openness to ideas among scientists - systems (devices) that keep living organisms alive - designing a model of a city as a model of a cell - representing city structures with the functions of the parts of the cell	Goal 4: Quality Education Goal 15: Life on Land Goal 11: Sustainable Cities and	6
	STEM activity	Professions and Cytology: The profession of cytologist- assisting doctors who treat cancer patients	Goal 8: Decent work and Economic Growth	2
	The body as a system	The body's reaction to stress - responding to danger - the structure of living systems - the skeletal system - the endocrine system - hormones and readiness to respond - the role of the circulatory system - the role of the respiratory system in the fight-and-flight response - the digestive system - the excretory system - designing a model for kidney purification of blood	Goal 3: Good Health and Well-being Goal 4: Quality Education	11
	STEM activity	Diabetes treatment technology - A healthy diet for diabetics - How to make a pacemaker for heart patients	Goal 3: Good Health and Well-being	3
	Energy as a system	Electrical power generation - generator - turbine - electrical conductors	Goal 7: Affordable and Clean Energy	4
	Unity Project: Support System	Body systems that may be affected by space travel - Designing an external support system that helps astronauts overcome the effects of space travel on their bodies - Health risks for future astronauts	Goal 3: Good Health and Well-being Goal 4: Quality Education	3
Get energy	Thermal energy and states of matter	How does energy transfer and innovation help eliminate famines in the world - Creating new materials that increase the possibility of heat transfer or insulation - Glass forming industry - Thermal expansion and contraction - Building bridges and buildings with expansion joints - Making thermometers	Goal 2: Zero Hunger Goal 9: Industry, Innovation, and Infrastructure	6
	STEM activity	Thermal expansion joints Design of a bridge with a protection factor against bending in hot weather or cracking in cold weather - Design of building structures - Technological methods for designing bridges to ensure a permanent safety element - Railway safety - Structural safety of structures - Safety measures and their implementation	Goal 9: Industry, Innovation, and Infrastructure Goal 4: Quality Education	6
	heat transfer	How to invent new materials - installing concrete to construct buildings and bridges - making products by gaining heat and then cooling them, such as glass - plastic is a solid material that resists burning - petroleum is a liquid that burns - making smart materials - smart clothes to control body temperature or light in the dark	Goal 9: Industry, Innovation, and Infrastructure	7

Unit	Concepts	Concepts and topics of SDGs2030 included in the lesson	Related goals	Repetition
	Unity project	Cooling with clay pots: Designing a cooling system without electricity that is easy to carry and move with to preserve food without damage	Goal 7: Affordable and Clean Energy Goal 4: Quality Education	1
	Interdisciplinary project	Designing a device that helps you complete your homework - Artificial intelligence in medicine, industry and agriculture	Goal 4: Quality Education Goal 9: Industry, Innovation, and Infrastructure	1
Water, weather and climate	Energy transfer during the water cycle	The water cycle in nature - weather change - climate change - energy transfer through the water cycle - drying of lakes - distribution of energy from the sun around the world - the hottest and coldest areas - the effect of gravity and solar energy on water cycle processes - water accumulation - condensation - precipitation - flow Surface - global warming - winds on Earth - wind cycle - how winds affect the climate of an area	Goal 13: Climate Action	16
	Temperature and weather changes	Atmospheric pressure - wind speed - rain gauge - humidity - meteorology - meteorological satellite - cultivating the desert through new agricultural methods adapted to the climate - rain shadow - atmospheric changes - uneven heating on the Earth's surface - weather forecasting tools - Effects of severe weather: floods, sandstorms, droughts	Goal 13: Climate Action Goal 15: Life on Land	14
	Unity project	Meteorological Reports: Work as a meteorologist and prepare a weather report for a newscast	Goal 8: Decent work and Economic Growth Goal 13: Climate Action	1
Adapting to changes	Adapt to survive	Genetic and environmental factors affecting the growth of living organisms - adaptation to harsh climates - the migration of birds in search of food sources or new habitats to reproduce and preserve the species - why people migrate from one habitat to another - survival - the basic needs of an organism that enable it to survive - factors Environmental factors affecting growth - the amount of food that the organism feeds on - environmental characteristics and methods of adaptation of organisms - biotic and abiotic factors and methods of adaptation - offspring - preservation of the species - adaptation of desert plants to harsh environmental conditions - factors that affect human growth and the development of his behavior: methods Living - Bad habits that harm health - Environmental factors (clean, healthy and safe environment) The situation of others living in some environments lack basic needs such as health care - The environment is unsafe - Water is far away or undrinkable - or it is difficult to obtain	Goal 3: Good Health and Well-being Goal 2: Zero Hunger Goal 13: Climate Action Goal 15: Life on Land	19

Unit	Concepts	Concepts and topics of SDGs2030 included in the lesson	Related goals	Repetition
		food - Sanitation services are not available Health - which leads to the spread of diseases - genetic factors. Adapt to survive Adapting to changes		
	Soil and environmental change	Environmental change - the importance of soil - soil formation - soil is the basis of ecosystems - desert soil - swamps - the effect of soil on earth systems - soil depletion - unjust cutting of forests - overgrazing - desertification - soil pollution - reducing soil erosion - climate and natural habitat destruction - Dynamic environment (hurricanes - floods - fires - volcanic eruptions - earthquakes) - climate change - increasing the number of a certain species above normal - waste and pollution - extinction	Goal 13: Climate Action Goal 15: Life on Land	20
	STEM activity	Using subsoil instead of topsoil to build sustainable homes - Ensuring shelter for humans around the world - Using greenhouses and concrete requires a lot of energy and produces a lot of pollution - Creating new chemicals that turn clay in the soil into a building material	Goal 4: Quality Education Goal 11: Sustainable Cities and Communities	4
	Unity project	Building eco-friendly cities: Designing a sustainable green city ecosystem	Goal 11: Sustainable Cities and Communities Goal 4: Quality Education	1
	Interdisciplinary project	Modern irrigation system design prevents water waste	Goal 4: Quality Education Goal 12: Responsible Consumption and Production	1
Total Repetitions				126
Percentage				53.3%

It is clear from Table 3 that the total frequency of concepts and topics related to SDGs2030 in science books for the fourth grade of primary school reached (77) concepts and topics, at a rate of 32.6%. In Table 4, it is shown that the total frequency of concepts and topics related to SDGs2030 in Science books for the fifth grade of primary school reached (83) concepts and topics, representing 35.16%. In Table 5, the total frequency of concepts and topics related to SDGs2030 in science books for the sixth grade of primary school reached (126) concepts and topics, representing 53.3% of the total list of concepts. The topics that must be included have a moderate degree of coverage, as they included between (32.16-53.3%) of the total concepts and topics that must be included in the content of the books, according to what the current study suggests. Thus, we find that the highest frequency of repetition was in the books of the sixth grade of primary school, followed by books The fifth grade, then the fourth-grade books can be explained as a result of the gradation of concepts and the increase in the number of topics covered in the books from one grade to the next according to the level of maturity of the students at this stage, where the curricula are built so that they graduate from

simple to complex and from easy to difficult, reaching the higher levels. As for the prevalence of SDG$_S$2030 in science books, the following table shows them:

Table 6. SDG$_S$2030 included in science 2.0 books at the primary stage and their frequency

N	SDGs2030 included in science 2.0 books	Repetition in fourth grade	Repetition in fifth grade	Repetition in sixth grade	Total	Rank
1	No Poverty	-	-	-	-	-
2	Zero Hunger	-	2	2	4	seventh
3	Good Health and Well-being	2	1	4	7	fourth
4	Quality Education	3	6	9	18	first
5	Gender Equality	-				-
6	Clean Water and Sanitation	1	6		7	fourth
7	Affordable and Clean Energy	5		2	7	fourth
8	Decent work and Economic Growth	1	3	2	6	sixth
9	Industry, Innovation, and Infrastructure	4		4	8	third
10	Reducing Inequalities	-				-
11	Sustainable Cities and Communities	1	1	3	5	sixth
12	Responsible Consumption and Production		2	1	3	eighth
13	Climate Action	1	1	5	7	fourth
14	Life Blow Water	1	4		5	sixth
15	Life on Land	2	5	4	12	second
16	Peace, Justice and Strong Institutions	-	-	-	-	-
17	Partnerships for the Goals	-	-	-	-	
	Total	21	31	37		
	N. of Lessons	53	48	45		
	Percentage	%39.6	%64.6	%82.2		

The previous results can be expressed in the   following graphic form:

SDG$_S$2030 included in science 2.0 books at the primary stage
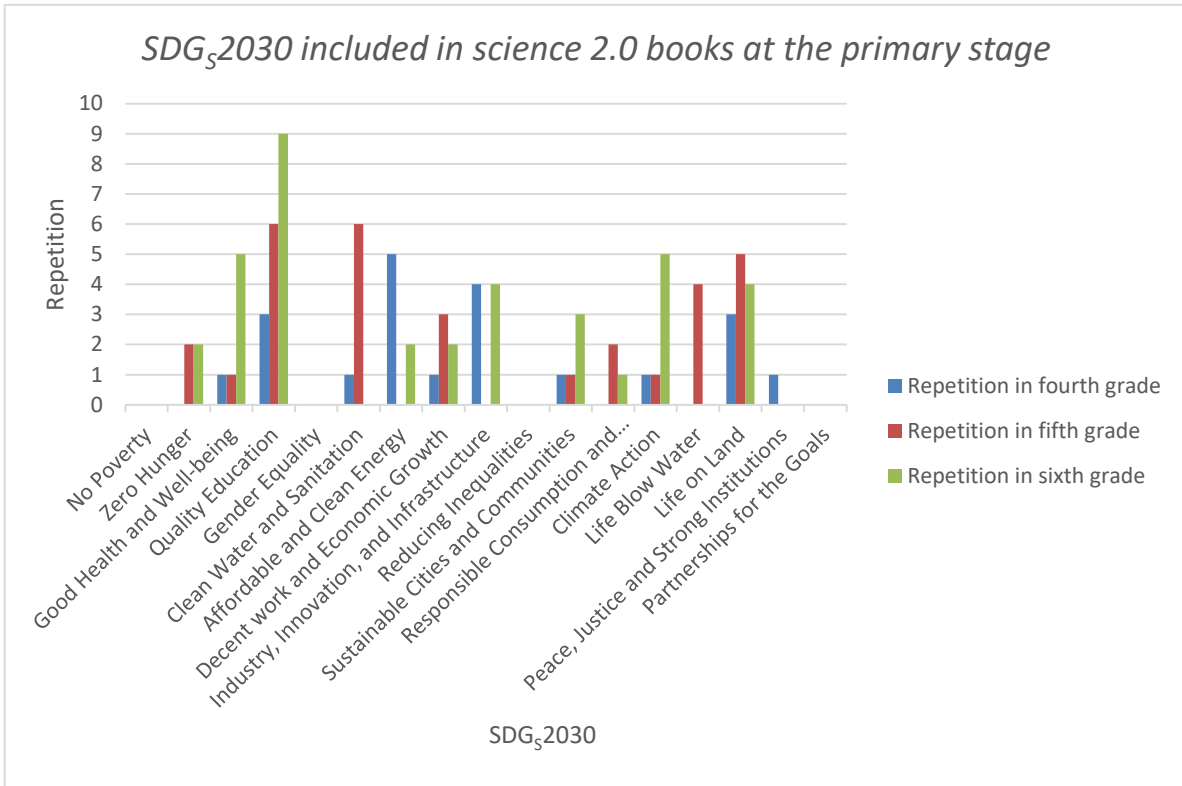
It is clear from the previous table that there is a clear discrepancy in the inclusion of concepts and topics that support the achievement of SDG$_S$2030 in science books for the primary stage. In science books for the fourth grade, the total number of lessons in which concepts and topics that support the achievement of SDG$_S$2030 appeared reached 21 lessons. A percentage of 39.6%, and in the fifth-grade books it amounted to 31 lessons, a percentage of 64.6%, and in the sixth grade of primary school, it amounted to 37 lessons, a percentage of 82.2%. This variance is due to the gradual presentation of science topics from general to specific, from simple to complex, across the three academic grades, and the increase in the density of information and concepts. Scientific studies increase the level of maturity of students, and we find that in the sixth grade, there is a more complex lesson than the lessons of the fourth grade of primary school, and this is why this variance appeared between the three grades.

As for the most common goals in science books for the primary stage, "Goal 4: Quality Education" comes in first place, as 18 lessons in

the books addressed it. This is due to the lessons' inclusion of engineering design projects, interdisciplinary projects, and STEM activities, which is one of the basic aspects of achieving the goal of quality education in the science subject. Science and the new curriculum also focuses on providing students with scientific and engineering practices largely and clearly, and in second place is "Goal 15: Life on Land," whose concepts and topics were addressed in 12 science lessons across the three grades, and this is due to the presence of a number of the units, it focuses on the concepts of adaptation, survival, biodiversity, ecosystems, natural resources, and other concepts directly related to science education. In third place is "Goal 9: Industry, Innovation, and Infrastructure," which was addressed in 8 lessons. This is due to the lessons of energy, motion, and heat. The subject matter changes focus largely on mentioning the new industries and materials that are created through the scientific concept under study, such as the manufacture of glass and copper and the innovation of new materials for the manufacture

of bridges and others.

In fourth place were goals: "Goal 3: Good health and well-being", Goal 6: Clean water and sanitation, Goal 7: affordable and clean energy, Goal 13: Climate action, as these goals were addressed in 7 lessons from science books, of course, because these goals are closely related to the topics of the science subject, there are topics related to energy and renewable sources of energy and topics about climate change and environmental changes. The topics also dealt with health dimensions related to humans in many treatments of scientific concepts, as indicated in the analysis tables (2, 3, 4), and ranked fifth place, "Goal 8: Decent Work and Economic Growth," topics related to it were addressed in 6 lessons. This is due to the focus of some lessons on clarifying the different jobs that the student can pursue in the future that are related to the scientific concept that the students are studying, such as jobs (astronaut - cell scientist - Wastewater treatment engineer).

In sixth place, "Goal 11: Sustainable Cities and Local Communities," was addressed in 5 lessons, where one of the lessons included a project for the unit entitled Building environmentally friendly, sustainable, green cities. This indicates the interest of the content in achieving this goal and the student's awareness of its importance, as well as Goal 14: Life below water." It was addressed in 5 scientific lessons. This is due to the presence of a common factor for studying water between Goal 6 Clean Water and Goal 14 Life under Water, both of which include important concepts about water as a natural resource.

In seventh place, "Goal 2: Eliminate Hunger," was addressed in 4 lessons, especially the lessons that emphasized the importance of food and healthy eating. There is an explicit mention in one of the lessons about famines around the world and how energy transfer and innovation help in eliminating famines in the world, which confirms that the lesson aims to focus on the goal of eliminating hunger and increasing students' awareness of it.

In eighth place was "Goal 12: Responsible Consumption and Production," which was addressed by 3 lessons in science books that focused heavily on reducing consumption and recycling waste, especially in energy lessons.

As for the goals that science textbooks did not address directly or implicitly, there are five goals, which are "Goal 1: No poverty - Goal 5: Gender equality - Goal 10: Reducing inequalities - Goal 16: Peace, justice and strong institutions, Goal 17 "Partnerships for goals." This is due to the nature of these goals, as they focus on the social aspect of sustainable development, which can be addressed in other academic subjects that are closely related to their subjects, such as social studies, economics, law, and religious education.

In general, it can be said that the degree of inclusion of the concepts of SDG_S2030 was moderate, and this is because the education reform system in Egypt, known as the new Education 2.0 system, has cooperated in building the science curricula with the "Discovery Education" - the American Foundation, which is a leading company in the manufacture and production Educational digital resources - It was modified in line with Egyptian education, so the results were moderately supportive of SDG_S2030, except for five goals that were not addressed.

Thus, the second question of the study has been answered.

To answer the third question of the study, "***What are the proposed recommendations considering the results of the study to include the concepts of SDGS2030 in science education 2.0 curricula in Egypt?***"

The researcher proposes several recommendations that can be followed to increase the degree of inclusion of the concepts and topics of SDG_S2030, especially about the goals that the study revealed are not addressed in the current curricula, and the following can be suggested:

1- Regarding the objectives: The objectives of the textbook and the objectives of each of the educational units must directly include objectives related to awareness of SDG_S2030, and the target objective must be indicated by its number and image that distinguishes it at the beginning of the unit so

that it becomes clear to the student and the teacher that this unit will achieve one of SDG$_S$2030 through it.

2- About scientific content: The results of the current study indicated that the degree of addressing the concepts and topics of SDG$_S$2030 was average according to the list provided by the study. Therefore, the study recommends the necessity of using the list of concepts and topics prepared by the study to include them in science books for the primary stage in its future developed version in every One of its objectives separately, especially about objectives that are not covered in science curricula at the primary stage. The study suggests adding the following concepts and topics according to each objective as follows:

Goal 1: No Poverty: Poverty - types of poverty (audited poverty - relative poverty) - the impact of poverty on the lack of basic human needs (clothing, food, shelter, health) - the impact of natural resource consumption on poverty - the importance of agriculture in combating poverty - sustainable energy and reducing poverty - ways to combat poverty - Diseases associated with poverty (malaria, cholera, tuberculosis) - Energy sources in poor communities - The relationship between malnutrition (hunger) and poverty - Waste management in poor communities - The impact of natural disasters on poor areas

Goal 5: Gender Equality: The concept of male and female in humans - Physiological differences between the sexes in humans - Differences in size, weight, and body shape - The effect of biological differences on health - Health awareness specific to each sex - The concept of gender equality in rights (education - work..) - Forms of discrimination against girls - The health harms of violence against girls - the crime of female circumcision - examples of male and female scientists who have a prominent role in the development of science (Marie Curie - Rosalind Franklin - Alan Turing).

Goal 10: Reduce Inequalities: Human nature - stages of human life - man and his sensory organs - the concept of disability - types of disabilities that affect humans - health needs of the disabled according to his disability - discrimination between people based on disability - harms of discrimination between people

Goal 16: Peace, Justice and Strong Institutions: School science laboratory - The importance of the laboratory and studying in it - Laboratory safety - Safety instructions in the school laboratory - Avoiding conflict and violence - Safely using tools and materials - First aid for experimental injuries - Fair distribution of materials and tools - Sustainable use of laboratory materials and tools - Laboratory and instrument maintenance practices for the sake of future generations

Goal 17: Partnership for the Goals: The concept of partnership - partnership between learners - partnership at the different grade levels - multidisciplinary activities in the school - community partnership - social responsibility - volunteer work - school initiatives with the local community to implement sustainable initiatives such as: planting green areas, and recycling waste.

3- Regarding educational activities: It is necessary to increase the number of curricular and extracurricular activities that support practices related to achieving SDG$_S$2030, especially activities that depend on more than one specialization to ensure the student's cognitive integration and support group activities outside the classroom, for example:

– Visiting remote residential areas and writing a report on the area's most in need in the student's environment as part of activities to achieve the goal of eliminating poverty.

– Participating in volunteer work to distribute food during the month of Ramadan to needy families to eliminate hunger.

– Participate in awareness-raising activities to prevent female genital mutilation, violence against girls, bullying, and harassment of girls with the goal of gender equality.

– Participate in awareness-raising activities on the rights of people with special needs in integration schools within science classes and provide them with assistance in obtaining educational opportunities within peer education, to achieve the goal of reducing inequalities.

– Participate in activities that decorate the school and classrooms and maintain the educational institution in a sustainable, green manner with the goal of sustainable cities and local communities.

– Participate in volunteer work activities and school initiatives with the local community to implement sustainable initiatives such as: planting green areas, and recycling waste within the goal of contracting partnerships to achieve the goals.

Activities may also include the following:

• External readings on sustainable development issues.

• Preparing, researching, and reporting on problems resulting from misapplication of scientific innovations.

• Holding seminars and panel discussions on SDGs2030.

• Organizing field visits to some places concerned with SDGs2030, such as visiting areas most in need, chemical factories, and natural reserves.

• Organizing interviews with some important figures, such as scientists, clergy, and environmental leaders, to ask ideas and questions related to the rights of future generations.

• Collecting newspaper articles and photos, whether from traditional newspapers or the Internet, that include a presentation of one of the sustainable development issues.

4- Regarding evaluation methods: The focus must be on performance-based evaluation and measuring students' performance in the educational projects and activities they undertake related to achieving SDGs2030, and a specific grade should be allocated to those goals within the original evaluation file for the student in primary education. Evaluation tools can be varied so Include:

• Regarding the cognitive domain: The evaluation should take place throughout the year by holding discussions with students about SDGs2030, as well as assigning them to conduct research and compile articles about them. Cognitive tests can also be used, whether objective or essay.

• As for the psychomotor domain: it can be evaluated through a note card to measure the extent of ability to implement the required scientific projects that support SDGs2030, as well as evaluation cards for the product that the student creates during the implementation of the projects.

• As for the emotional domain: measures of attitude toward SDGs2030, measures of inclinations, aspects of appreciation, and other measures that show the student's emotional tendency toward the importance of preserving the planet and the rights of future generations can be used.

Recommendations:

1- A need for educational experts and science curriculum developers at all educational levels to pay attention to integrating the concepts of SDGs2030 that are not addressed in the current curricula.

2- The need to train student teachers in colleges of education and in-service teachers on how to implement and integrate educational activities to achieve SDGs2030.

3- Using the recommendations proposed in the current study to develop science curricula at the general education levels (primary - middle - secondary) considering SDGs2030.

Suggestions:

1- Conducting a study like the current study on science curricula in other countries

2- Evaluating and developing science curricula at the intermediate and secondary education levels considering SDGs2030.

3- The effectiveness of science teacher preparation programs in developing awareness of SDGs2030 among student teachers.

4- A proposed program for developing teaching practices related to SDG$_S$2030 among pre- and in-service science teachers.

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