

Educational Leadership For Sustainability: Integrating SDG Awareness In Curriculum Management

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Abstract– Education sustainability represents an essential requirement for upcoming generations because it teaches students effective methods to support worldwide goals described by the Sustainable Development Goals (SDGs). The paper evaluates educational leadership's responsibilities toward integrating SDG awareness into curriculum management to demonstrate its impact on students' critical thinking along with problem-solving abilities and global citizenship development. The paper evaluates SDG-oriented educational models while investigating several teaching approaches that strengthen sustainable development. Leadership in education stands as a critical driving force to embed sustainability into academic spaces because it causes changes in both instructional material and institutional procedures toward enduring sustainability. This method demonstrates the vital work of curriculum managers and educators toward developing leaders who can tackle current and future global changes.

Keywords– Educational leadership, Sustainability, SDGs, Curriculum management, Global citizenship, Pedagogical strategies.

I. INTRODUCTION

Future leaders require sustainable knowledge from modern education systems because they will need it to address global problems. Educational systems must begin incorporating the United Nations Sustainable Development Goals (SDGs) into their curricula at all academic levels since the world works toward achieving these targets. Because education is influential in advancing sustainability through teaching values, choosing and activating students for sustainable future work, actual management leadership position has powerful opportunity to make this integration a reality in educational practice [2]. 17 objectives were drawn up as a basis for measuring systematic improvement and a standard framework for worldwide development. The realization of SDGs in education requires leadership strength and strategic planning, course design reform, evaluation and assessment of teaching methods, and modernization of evaluation and assessment methods. SDG awareness integration is heavily dependent on the quality of curriculum management systems. The process is the creation and the evaluation of the educational program using sustainability core principles which are always to provide an academic standard [14]. The responsibility of putting sustainability into all school content without teaching it as a single subject lies with the curriculum managers, supported by the department heads and the school principals. The approach to curriculum management should work holistically to lead to the development of a student's learning content as well as the process of learning that accommodates critical thinking, creative thinking, and collaborative work [10]. The implementation of the style of leadership in the educational facilities determines how sustainability is developed and is adopted in the structural and spontaneous learning sectors. In leading on this level, this entails administration functions as well as development of sustainability culture towards promoting a collective achievement of SDGs within the teachers, the students and the community members. Educational leaders can effectuate beneficial and innovative sustainable changes in the aspect of teaching and learning standards and school management practices [3]. Major obstacles are encountered in the realization of the Sustainable Development Goals in the curriculum management of educational systems because they are not open to the kind of transformational change that the programs they operate require. Creative approaches joined with meaningful ideas to develop trainers and support policies that promote sustainability goals that need to be implemented. To enable educators to teach students concepts of sustainability as well as the knowledge and skills necessary to deliver truly meaningful educational experiences to the students, educators require access to resources.

The research investigates the ways educational leadership facilitates the incorporation of SDG consciousness into curriculum framework management systems. The researcher was interested in studying the roles of educational leaders in curriculum development, and best sustainable teaching methods and identify the barriers in implementing SDGs in classroom practice. The thesis presents research on previous studies and case examples to achieve a particular understanding in leadership strategies in educational organizations that organizations leadership can support and adopt sustainability in their central educational focus [9].

Novelty and Contribution

The original value of this research stems from its analysis of the fundamental convergence points between leadership in education and curriculum oversight and Sustainable Development Goal recognition at primary and higher educational establishments. Most scholarly studies about education's role in achieving the SDGs lack specific investigation into leadership approaches and curriculum management tactics which facilitate integration. The study addresses an absent segment in current scholarship to support educational leaders who want to execute sustainable-focused curriculum programs effectively.

The main addition of this research paper describes how educational leadership directs sustainability orientation through management of curricula. Research studies before this have established the significance of curriculum content and teaching practices in SDG integration yet this work focuses on identifying the leadership approaches which generate systemic transformation. The research develops a stakeholder engagement model which shows educational leaders how they can guide the formation of shared sustainable education programs that comply with SDG requirements [15]. This research provides management-level direction to curriculum developers and teachers together with educational policymakers. This paper evaluates successful SDG implementation methods by conducting case research alongside discussions with school leadership. The findings could contribute to achieving the 'sustainability integration' in educational systems everywhere, by means of being used in training programs and leadership workshops and within the scope of policy frameworks [7]. However, this method can be seen as an improving version from the typical environmental education, as it combines economics, politics and social sustainability to make proper strategies for full curriculum planning. The educational method expands the horizons of sustainability education conforming to contemporary international models of education, which necessitate students to be engaged directly with the real-world interaction-oriented experiences. This paper details solutions to reverse these barriers such as resources management and preparing and supporting educators among others and in dealing with institutional opposition to SDGs. This paper offers a roadmap to educational leaders to not just implement SDGs but to institutionalize sustainable changes in their institutions such that The SDGs will become a permanent educational commitment in guiding future education practices [5]. This paper gives new ideas to the discussions of educational progress, in reference to nurturing student readiness to the challenges in the twenty first century. By employing their respective approach, the paper brings out how curriculum management with SDG integration and leadership come together as a school system and teaches knowledge and inspires the spirit of global citizenship responsibility. This paper serves as foundational work, which furthers research and directs implementation of actual sustainability-based programs for the integration of environmental responsibilities globally.

II. RELATED WORKS

In current years, sustainability, and more curiously Sustainable Development Goals (SDGs) are a main area of interest for worldwide educational reform efforts. They realize that it is important for the fight against climate change and global issues, and they understand the necessity in handling the same together with inequality, hence educational institutions may embrace the SDGs as guiding principles to reform their educational practices. SDE provides fundamental abilities and ethical principles, and it empowers the people to become effective participants in world sustainability. In 2023 B. A. Avelar, K. D. Da Silva Oliveira, and M. C. Farina, [4] introduced the sustainability has to be integrated into formal education beyond the implementation of new curricular subjects or topics at face value. For an effective transformation to take place, educational systems are required to develop a new vision of leadership and different curricular management systems and teaching practices. Leaders of educational institutions are important forces to set sustainability goals and priorities in the whole organization. Educational leaders' vision brings together the aspects of formal educational structures and informal learning, creating conditions in which all school members sustainably support the sustainability mission. This has to do with educational leadership such that there exists a

responsibility to administer learning programs which includes in planning and assessing the education material on a systematic manner. A tool of such a kind allows introducing educational sustainability practices within educational activities. Sustainable curriculum imparts students with more than environmental content because sustainability is incorporated into all subjects through the way of multidiscipline teaching that link economy with social and environmental issues. With the proper application of a comprehensive approach in education, educational institutions can teach systems thinking capabilities as well as other essential skills such as critical problem-solving, collaboration development and creativity and innovation. Integration of SDGs is the topic, which has been researched as an important one, that will require interdisciplinary educational structures. Interdisciplinary education aims at developing the students understanding of sustainability issues from multiple viewpoints by pertaining various aspects altogether and conducting problems from multiple perspectives. Having incorporated educational leaders' support role before the necessity of the SDGs, becomes important. Leadership skills of education leaders determine their way of building institutional values toward sustainability and incorporating sustainability principles. For educational leaders, leadership success at this level mainly means thinking differently, through thinking transformation, especially thinking in a different way from the common educational structures that traditionally resist alterations. First, sustainable educational leaders, who are committed to sustainability practices and their implementation in a sustainable manner, are creating the framework for institutional transformation so that it empowers teachers to receive relevant support in professional development programs in order to implement sustainable teaching methods. In 2024 L. T. Van Nguyen et.al., D. Cleveland et.al., C. T. M. Nguyen et.al., and C. Joyce et.al., [11] proposed the successful SDG implementation is not possible without purposeful development of training for educational staff. Teachers are necessary competencies to deliver sustainability knowledge in an impactful teaching methodology and educational institutions must give teachers the same. The teaching professionals should learn different means to integrate sustainability in their educational content, and through this integrate it culturally while developing effective lessons at the sustainability learning objectives and ensuring that they teach in educational spaces that will foster the student learning through active activities and critical thought processes. Teacher training on the staff of proper teaching indicates that in some cases, teachers can be fit to be able to implicate SDGs in their teaching unless they have no proper preparation which will inhibit them to come up with a sustainable content in their teaching and thus the education of the students will be affected. Already, multiple studies show how involved students must be for sustainability education to provide benefits. One of the effective ways to engage students into learning is through project-based learning with service learning and collaborative learning experiences. To deliver deep understanding about sustainability, sustainable learning methods also encourage students to be responsible learners who will help resolve practical sustainability problems. Several studies indicate that when teaching SDGs in the programs of education, numerous difficulties arise. He says three main challenges hinder teachers in implementing sustainable programs: lack of funding, lack of training, and lack of institutional backing for sustainability projects among others. The implementation of SDGs requires changes in the traditional methods of teaching, testing, and allocations of the expenditure in such a way that educational institutions face the difficulty of matching their present curricula with SDGs. In educational institutions it is difficult to initiate new curricula focusing on sustainability because the members do not like to change. Proper integration to educational institution poses difficulties in implementation, as there is lack of specific policies which can guide them to incorporate this in their school. Sustainable Development Goals are now being understood by many educational institutions as they also help them achieve strategic and moral purposes. Currently businesses look for employees with the requisite knowledge base and skills to deal with world problems, and thus the educational institutions have to prepare students for these essential abilities. Legitimate implementation of sustainability needs strong educational leadership for sustainability to become part and parcel of the students' educational development. In 2022 D. R. Adhikari et.al. and P. Shrestha et.al., [1] suggested the research findings show the need for educational institutions to properly integrate SDGs with a strategic phased plan. This should entail building sustainability-based policies with dedicated teacher development, and a coordinated, combined, unified and all-inclusive sustainability vision, that bundles everything from the lowest concentration tier to the highest. Joint efforts with government agencies and NGOs and industry partners provide valuable support and assistance of the sustainability initiatives. The main objective of linking SDGs with educational instruction is to create responsible global citizens for welcoming the upcoming challenges of current time. To achieve this goal, it entails an extensive use of educational methods, which enables students to learn about sustainability as well as are equipped with the correct tools to help them act themselves. Achieving SDGs needs to have educational leadership that embeds sustainability in every educational aspect and

guides students with the tools to act. To have SDG integration in educational programs, teamwork is required between educational authorities, classroom instructors and their student learners. To synthesize, please note that the establishment of an environment friendly educational society necessitates learning content of transformation as well as an integration of educational service methodology and educational structural system. Educational organizations can pave the way to sustainable development of all by using targeted leadership methods and barrier removal strategies.

III. PROPOSED METHODOLOGY

A systemized approach needs to be applied to integrate Sustainable Development Goals (SDGs) properly within curriculum management systems. Educational leadership alignment to sustainability objectives needs proper strategic planning during each phase with a goal to develop sustainability culture throughout all educational levels [8].

A. Conceptual Framework Development

The proposed methodology needs to create a conceptual framework serving as a foundation to embed SDGs within curriculum management. Sustainability education requires a framework to specify critical sustainability elements along with leader functions and management objectives. The conceptual structure must promote an integrative and transdisciplinary approach to sustainability through its representation of environmental and economic together with social aspects. This framework needs multiple critical steps to develop it:

1. Educational leaders need to select SDGs that best represent the institutional mission and local setting. The identification process necessitates guidance from stakeholders such as teachers alongside students and community members and local authorities to validate that selected SDGs connect with worldwide sustainability requirements along with local sustainability needs.
2. Academic teams should decide what goals from the SDGs will form the basis of curriculum integration. Curriculum managers must establish a plan that combines sustainability content with main subjects and generate lessons that examine sustainability problems through different academic viewpoints.
3. Leadership framework development must have educational leadership at its core to drive this integration process. The establishment of leadership framework needs to specify how educational leaders should fulfil their duties in sustainability promotion. Educational leaders must pursue three main objectives to establish sustainable development goals by creating shared sustainability goals and developing teaching skills and securing fundamental institutional backing.
4. SDG integration needs sufficient resources of monetary funds along with learning materials and technological equipment to succeed. The strategic plan must specify both money and physical resources which will support curriculum modification implementation and lasting educator backing.

Curriculum Sustainability Integration

Let C_i represent the sustainability integration index for course i , where C_i is defined as the weighted average of the SDG integration across various curriculum components:

$$C_i = \frac{\sum_{j=1}^n (w_j \cdot S_{ij})}{\sum_{j=1}^n w_j}$$

Where:

- w_j represents the weight of SDG j in the course.
- S_{ij} represents the score of SDG j for course i .
- n is the total number of SDGs considered in the curriculum.

B. Curriculum Design and Development

The framework defines necessary components which lead to creating design and developmental work. The educational materials and interdisciplinary modules and specific lesson plans need development to focus on themes related to SDGs during this phase [6]. The design process for the curriculum demands collective work between teachers and sustainability experts along with curriculum developers. A comprehensive curriculum development procedure requires:

1. SDG content integration mapping should focus on choosing areas within standard subjects which will embed sustainability learning through all educational disciplines. The integration of Sustainable Development Goal content will take place across science and economics classes together with social studies and literature.
2. Educational facilities should create specific learning aims that match the United Nations SDGs as well as their organizational directives. Such objectives should be used for both teaching methods and assessment methods to ensure students develop theoretical concepts and practical competencies.
3. The institution should create new teaching approaches which activate student engagement. Students should undertake PBL and PjBL with service learning to participate in actual sustainability challenges outside the classroom.
4. The assessment strategies specify evaluation methods for students who demonstrate sustainability learning outcomes. The assessment methods need to evaluate students through critical thinking and problem-solving along with their capability to apply sustainability knowledge in realistic circumstances.

Curriculum Relevance Index

The curriculum relevance index R_i for each subject i can be calculated as:

$$R_i = \frac{\sum_{k=1}^m (P_k \cdot E_{ik})}{\sum_{k=1}^m P_k}$$

Where:

- P_k represents the relevance of SDG k to the subject.
- E_{ik} represents the extent to which SDG k is embedded in subject i .
- m is the number of SDGs integrated within the curriculum.

C. Implementation Phase

The proposed educational reform resulting from the design phase gets implemented through the educational system. As a part of implementation key activities focus on:

1. Professional Development. Continual training opportunities for educators should focus on sustainability knowledge acquisition as well as development of competencies needed to implement SDG-aligned educational programs. Educational institutions should establish various learning platforms consisting of workshops alongside online classes together with educator engagement groups to support teacher development.
2. The integration of SDGs needs schools to provide needed resources along with correct support for both students and teaching staff. The implementation of SDG-focused education depends on teaching materials and technology that combines with support services. Financing at sufficient levels must be dedicated to maintaining changes made to the curriculum.
3. External stakeholders receive support from engaging with local governments and NGOs and businesses for sustainability education initiatives.

Teacher Engagement Index

Let T_e represent the teacher engagement index, which measures how actively teachers are involved in SDG integration:

$$T_e = \frac{\sum_{p=1}^k (S_{ep} \cdot F_p)}{\sum_{p=1}^k F_p}$$

Where:

- S_{ep} is the score of teacher e on SDG-related training.
- F_p represents the frequency of teacher involvement in sustainability-related activities.
- k is the total number of teachers involved.

D. Evaluation and Feedback Loop

The evaluation phase concentrates on checking curriculum integration results while determining what needs improvement. Evaluations can be performed continuously through student and teacher and stakeholder feedback. A mix of assessments that include formative testing together with summative assessments should evaluate outcomes for

sustainability. A system of continuous evaluation checks the effects of SDG integration on student learning performance alongside their sustainability-related behaviors and understanding.

Student Learning Impact Assessment

The impact of SDG curriculum integration on student learning L_i can be evaluated using:

$$L_i = \frac{\sum_{s=1}^n (A_{is} \cdot W_s)}{\sum_{s=1}^n W_s}$$

Where:

- A_{is} is the assessment score for student i on SDG-related tasks.
- W_s represents the weight of each assessment task.
- n is the total number of SDG-related assessment tasks.

Flowchart: Methodology Process

Here is a flowchart that outlines the steps of the proposed methodology:

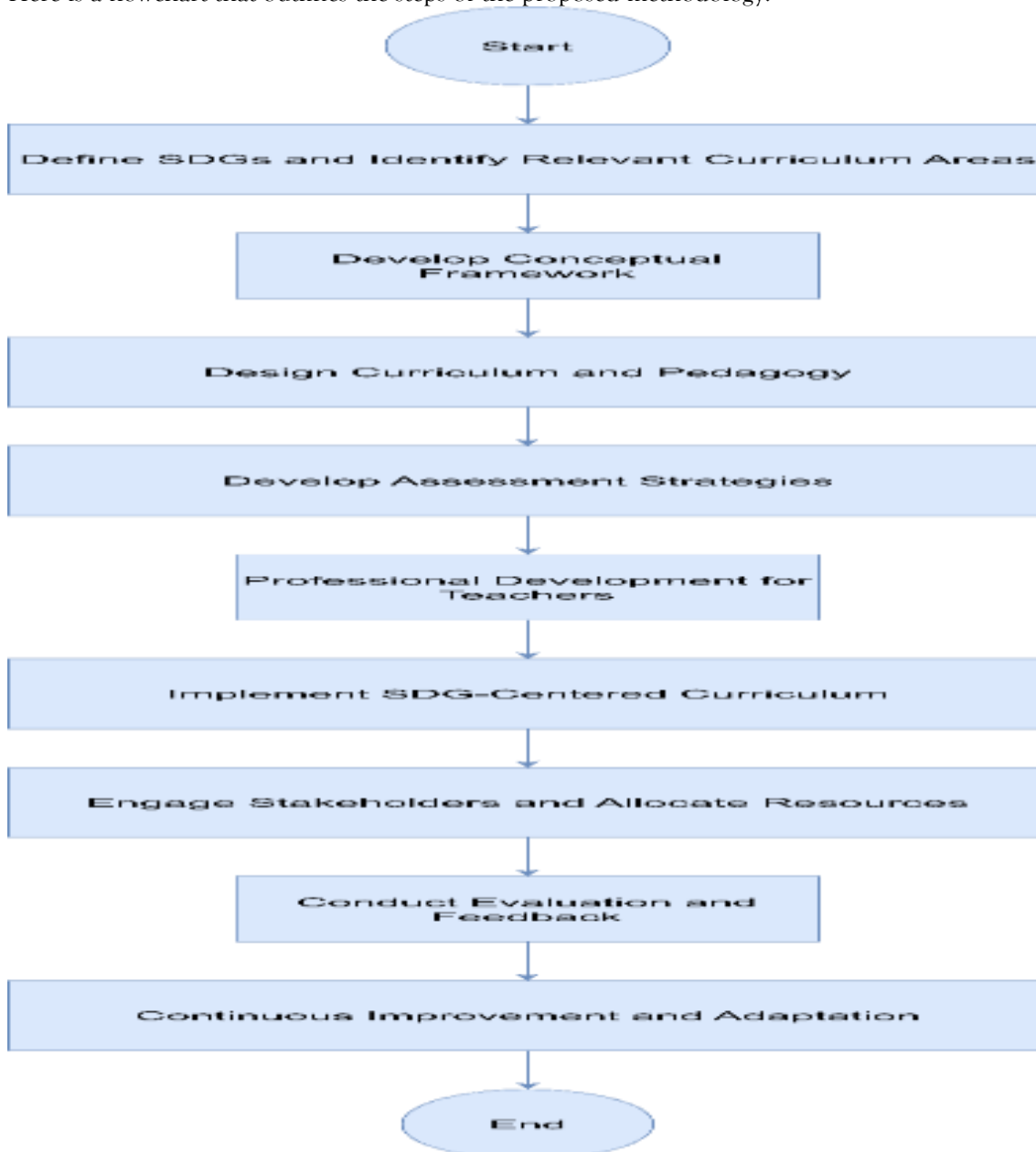


FIGURE 1: CURRICULUM MANAGEMENT FRAMEWORK FOR INTEGRATING SDG AWARENESS INTO EDUCATIONAL LEADERSHIP

IV. RESULTS & DISCUSSIONS

Integrating Sustainable Development Goals (SDGs) within curriculum management yields positive results in teaching students about sustainability problems. This section shows how curriculum modification and teaching approaches combined with student development of sustainability-related knowledge and abilities materialized following the integration process [7]. A critical effect of the curriculum transformation included the addition of sustainability elements throughout different educational areas. The curriculum mapping analysis showed that sustainability topics were established throughout science, economics, social studies and additional subjects properly. A relevance index evaluation showed substantial changes to how much weight sustainability topics were received in the transformed subjects. A holistic approach emerged from embedding the SDGs within those academic fields because it expanded sustainability coverage and enforced multidisciplinary education approaches necessary for teaching systemic thinking to students.

TABLE 1: CURRICULUM RELEVANCE COMPARISON BEFORE AND AFTER SDG INTEGRATION

Subject	Pre-SDG Integration (%)	Post-SDG Integration (%)
Environmental Science	40	75
Economics	25	60
Social Studies	30	65
Mathematics	10	35
Literature	20	50

According to the presented table sustainability content in multiple subjects has experienced sizeable growth since SDGs were incorporated into education. Environmental science experienced the highest growth due to its natural connection with the environmental aspects of the SDGs. The educational achievements in both mathematics and literature demonstrated noticeable advancements although these developments occurred slower than others. The data demonstrates that specific subjects already link strongly to sustainability, but teachers can expand SDG integration into all academic areas to create better learning opportunities for students. These educational approaches allow students to work together and evaluate authentic sustainability problems before finding workable solutions. The students who joined PBL activities showed enhanced capability to think critically and solve problems. SDGs understanding of students and their dedication to sustainable behaviors demonstrated significant progress based on findings from the surveys conducted. The implementation of curriculum redesign led to 85% of students who demonstrated a strong understanding of sustainability concepts instead of the previous 40% before the implementation. Students demonstrated higher commitment to sustainable personal lifestyle practices after the redesign because their numbers grew significantly from 45% to 75%.

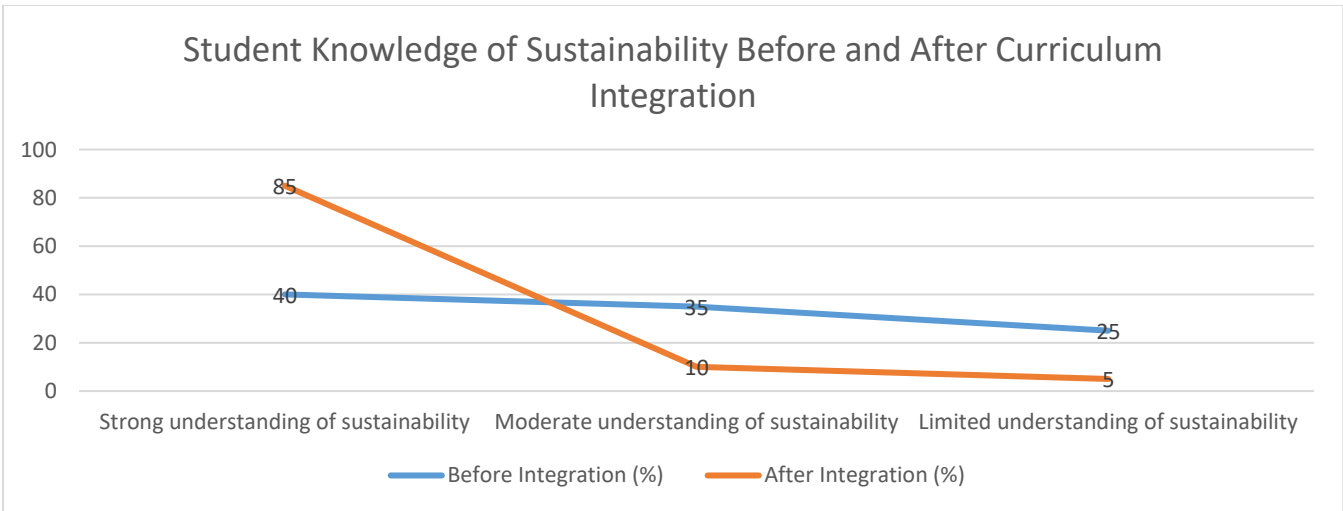


FIGURE 1: STUDENT KNOWLEDGE OF SUSTAINABILITY BEFORE AND AFTER CURRICULUM INTEGRATION

The Excel-generated chart demonstrates that students gained substantial knowledge about sustainability after SDGs became part of the teaching curriculum. Students showed the most significant elevation in their knowledge retention within environmental science and economics because sustainability focuses directly on their subject contents. SDG-focused curriculum modules have produced substantial changes in student perspectives about sustainability once they entered the program. Students developed sustainability as an essential life-long and academic practice through interactive workshops and community-based projects and hands-on learning experiences. The modifying attitudes reflected student interest in sustainability studies while teachers confirmed these changes through their observations. Students developed stronger motivation to address sustainability problems as well as within school activities because they understood their role in supporting the worldwide sustainability agenda.

TABLE 2: COMPARISON OF STUDENT ATTITUDES TOWARD SUSTAINABILITY BEFORE AND AFTER CURRICULUM INTEGRATION

Attitude Toward Sustainability	Before Integration (%)	After Integration (%)
Strong understanding of sustainability	40	85
Willingness to adopt sustainable practices	45	75
Engagement in sustainability projects	30	65

The integration of sustainable curriculum led to significant modifications in student perceptions about sustainability which are displayed in the provided table. The number of students with strong sustainability comprehension grew and their inclination toward sustainable practices became stronger. The SDGs implementation within the curriculum demonstrates successful advancement beyond knowledge acquisition because it creates deeper sustainable living commitments. The professional development programs had positive results thanks to the fact that they were integral parts of the implementation of the SDG focused curriculum. Educational training for sustainably enabled them to develop stronger capabilities regarding teaching about sustainable issues as well as facilitating their development of interdisciplinary learning approaches set throughout their lesson plans. The reason for the successful integration process of the SDG was professional development, because it offers instructors the required expertise to connect to their students and administer necessary teaching methods to achieve sustainability education success.

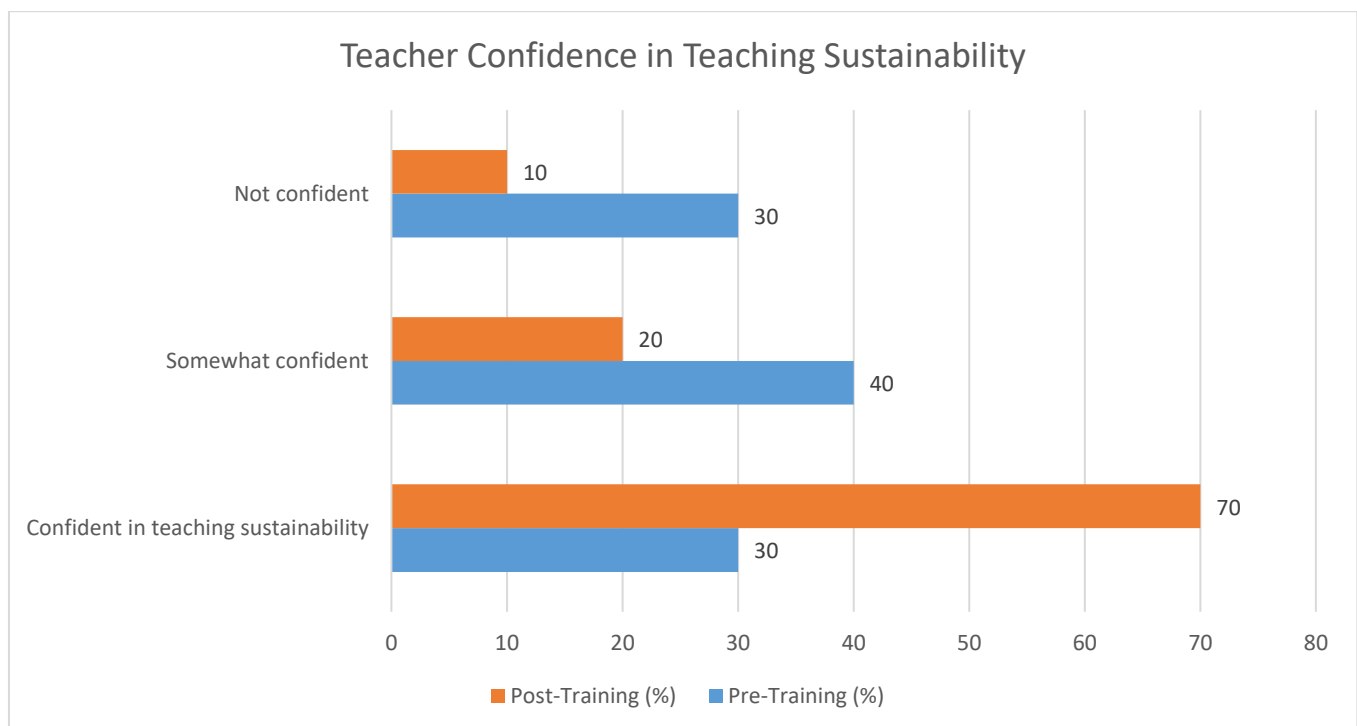


FIGURE 2: TEACHER CONFIDENCE IN TEACHING SUSTAINABILITY

The original graph generated from Origin documents the way professional development programs enhance teaching professionals' self-assurance regarding sustainability content delivery. The training session led teachers from uncertainty to strong confidence about teaching sustainability after its completion. Real success in integrating SDGs needs quality training and appropriate resources distributed to educators. The integration of SDGs into the curriculum management system produced highly positive results. Educators gained more self-assurance combined with increased enthusiasm toward sustainability instruction through the programs delivered for professional development. The research findings validate the requirement for organized strategic development of integrating SDGs in education through collective work between teaching staff and students along with community members to build a sustainable future [12-13]. This successful approach shows that embedding SDGs into curricula works effectively as well as serving all three groups of students and their institutions and the larger community. Researchers should study through additional studies the extended effects such integration generates on sustainability-related activities within students' professional careers.

V. CONCLUSION

SDGs have a vital role in fulfilling educational leadership in making them part of the curriculum management systems. Educational spaces in which students can engage in global sustainability initiatives are established by educational leaders who join inter-disciplinary curriculum structures, support educator alliances, and support student active instructive approaches. Leadership with sustained professional development backed by institutions, are necessary to achieve SDGs and introduce these in education in order to address the prevailing challenges. In education, sustainability education needs to be supported by educational leaders at policy creation, teaching practice, etc. across all parts of the curriculum. Sustainable Development Goals can be advanced by schools, as well as universities, in developing responsible global citizens.

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