

Examining Teachers' Competencies in Implementing Education for Sustainable Development (ESD) at the Primary Level: A Mixed-Methods Study

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Abstract

The purpose of this research is to provide a detailed analysis of skills that the teachers at primary schools must master to make the Education for Sustainable Development (ESD) successful at the primary level. The sample data consisted of 30 teachers of semi-government and private primary schools in Mardan, Pakistan, who were subjected to a quantitative evaluation using questionnaires. In the study, they are going to find out what schemes, competencies, and skills are needed, as well as what knowledge can be called upon to motivate sustainability among young learners. The factors that are addressed in the study are how teachers whose family background and moral values contribute to their capacity to inculcate concepts of ESD in their classrooms. It also evaluates how the educators approach the subject of teaching using ESD in their dedicated lesson plans and what the obstacles during the implementation process of ESD could be. The paper concludes that although there are strong intentions of putting in place ESD, the efforts are disappointing due to inadequate formal training on ESD, the interactivity of students, diversity, and curriculum match-up.

Keywords: Education for Sustainable Development, Teachers' Competencies, Sustainability

Introduction

Education for Sustainable Development (ESD) is to highlight sustainability in the academic work of young people by joining environmental, social, and economic aspects of learning (Kioupi & Voulvoulis, 2019). The Rio de Janeiro Earth Summit, which the United Nations (UN) introduced ESD (1992), and then the UN Committee on Sustainable Development set out guidelines for implementing these concepts in schools worldwide (1996). ESD was once again recognized as important in 2002 when the UN General Assembly (2005-2014) introduced the United Nations Decade of Educational Development for Sustainability.

Today, when global issues such as climate change, the loss of biodiversity, and inequality are at their highest, the significance of education in supporting sustainable societies is at its peak (Kurangking et al., 2023). ESD is an approach promoted by UNESCO which trains learners to manage all kinds of issues in society, environment and economy (UNESCO, 2012). Recognized by the United Nations as part of the foundation of the Sustainable Development Goals. Because of ESD, individuals learn to reassess how things are done and support positive changes for the good of the world. Although ESD applies to all school levels, using it in primary education matters more (Manuel & J. Paulo Davim, 2019). Primary schools play a key role in forming how young students act and think, so teachers become important in preparing them for sustainability (Ärlemalm-Hagsér & Sandberg, 2011). Promoting sustainable development starts at the primary level, mainly because of the importance of education there (Lamanauskas & Malinauskienė, 2024). Carrying out ESD effectively depends on how knowledgeable and skilled educators are in sustainability, various ways of teaching, and promoting thinking, empathy, and problem-solving (Sadaf Taimur & Sattar, 2020). Education for Sustainable Development (ESD) heavily relies on the involvement of teachers. They are

expected to possess a set of skills needed to make students aware of and advocate for sustainability, which is beneficial to the future of all people (Pegalajar-Palomino et al., 2021).

Both the CSCT model and the ECE framework stress that educators should have systems thinking, reflect on ethics, and engage students in finding solutions to sustainable issues (Rieckmann & Barth, 2022). Despite these methods, ESD pedagogical approaches on how to effectively introduce the concept of ESD to children at the primary level have not been researched widely. This paper aims to bridge this gap by comprehending the applications of ESD in primary schools and the challenges that teachers encounter with these approaches. Understanding of these instruction methods is extremely significant to enhance the means of enhancing the effectiveness of ESD for the generations to come (Rieckmann & Barth, 2022).

Background of the study

The concept of ESD is crucial because it addresses an under-explored area and requires highly competent teachers for its integration in primary education. Global issues such as climate change, the loss of biodiversity, and inequality are at their highest; the significance of education in supporting sustainable societies is at its peak (Kurangkaning et al., 2023). Promoting sustainable development starts at the primary level, mainly because of the importance of education there (Lamanauskas & Malinauskienė, 2024). Knowing about poverty, inequality, and climate change from an early age creates a generation of world citizens who realize the world is connected and are encouraged to help solve worldwide problems (Carmona et al., 2024). We make future generations responsible, they will have the knowledge and skills to address the sustainability issue of tomorrow (Imran et al., 2024). Still, carrying out ESD effectively depends on how knowledgeable and skilled educators are in sustainability, various ways of teaching, and promoting thinking, empathy, and problem-solving (Sadaf Taimur & Sattar, 2020). Education for Sustainable Development (ESD) heavily relies on the involvement of teachers. They are expected to possess a set of skills needed to make students aware of and advocate for sustainability, which is beneficial to the future of all people (Pegalajar-Palomino et al., 2021). Through the concept of sustainability, teachers are able to cover these problems in an extremely varied topic, including science, geography and even social studies (Holfelder, 2022). Those teachers who recognize how education affects society are well-equipped to be leaders outside their classrooms as well. Teachers are encouraged to join up with fellow teachers and community leaders to support making policies that ensure sustainability education is taught everywhere (Ferguson et al., 2021). There is not a single ESD framework included in the curriculum; teachers have difficulty deciding what should be included and how to assess it (Hung & Pan, 2025). Both the CSCT model and the ECE framework stress that educators should have systems thinking, reflect on ethics, and engage students in finding solutions to sustainable issues (Rieckmann & Barth, 2022). The lessons learnt will be useful to the policymakers, educators, and curriculum developers as they will have a better insight into how primary educators can successfully integrate ESD principles in their teaching process. By identifying the most significant teachers' competencies and overcoming existing challenges, this research can guide the creation of educational environments that support the development of sustainable behaviors in young learners.

Literature Review

Many Research studies have shown the importance of the implementation of Education for Sustainable Development. ESD is considered a relevant aspect of education in most countries (Kioupi & Nikolaos Voulvoulis, 2019). ESD enables students to have the skills and expertise to confront major issues that occur in the world. Moreover, teachers' competencies aim at assisting the students to approach issues concerning sustainability in a positive manner (Kioupi & Voulvoulis, 2019). To teach ESD, an individual must be critical thinkers, engage in systems thinking, demonstrate empathy, collaborate effectively with others, be ethical, and utilize the CSCT and ECE frameworks. These theories state that effective learning occurs when we consider and combine all three of these dimensions (Vare et al., 2019).

In addition to that, studies show that the methods based on students learning through doing and self-evaluation allow them to refine their critical thinking and problem-solving abilities (Riess et al., 2022). Also, teacher preparedness is a significant factor in the success of ESD in primary schools. Most educators believe that they lack the training or the materials to integrate sustainability in their classes. In addition, ESD-related skills are hardly addressed in teacher education, which creates a massive disparity between the school policy and classroom practice (Noor Hamwy et al., 2023).

Many difficulties accompany the implementation of ESD, including the lack of sufficient time in the curriculum, resources, and the appropriate help given to schools and educators. In most primary schools, individuals tend to discuss more about the environmental care, yet not much about social and economic topics. Furthermore, problems with having enough resources and enough help from school leaders make it harder for teachers to use ESD the way it's meant to be

used (Abo-Khalil, 2024). The Competency Framework for ESD from UNESCO explains that, to support ESD, educators need to focus on systems thinking, collaborating with peers, and thinking about the future. Nevertheless, there is not much research that looks directly at primary teachers' ability to meet the new requirements. UNESCO-commissioned experts highlight that ESD should focus on teamwork, exchange of opinions, being involved in the whole structure, creating new solutions, and encouraging active learning (Rieckmann & Barth, 2022). Focusing on the development of ESD skills is now accepted and recognized by most (Rieckmann, 2018). All in all, competence means having a combination of knowledge, skills, understanding, values, attitudes, and desires that help a person act effectively in life, in a certain field (European Commission, 2013). ESD focuses on teaching learners about sustainability and provides them with the knowledge and skills they need to contribute to sustainable development. Although debates have mainly revolved around how ESD is taught and what should be included through policies, the role of teachers is now being noticed more often. Timm and Barth (2022) describe how teachers perceive and carry out ESD as part of their teaching activities. Pedagogically, to use ESD competencies well, teachers need to change from regular chalk-and-talk lessons to more interactive, cross-subject, and active learning for critical thinking, group work, and solving problems students might come across in actual life (Tejedor et al., 2019; Brandt et al., 2019). It has been recommended that student teachers be given special courses, a curriculum that includes sustainability, and opportunities for practical learning to acquire competency (Imara & Altinay, 2021). Education for Sustainable Development (ESD) is seen as an important way of teaching people about how to take care of social, economic, and environmental issues so that they can become better and responsible citizens. One of the ways that education contributes to occurs through literature commenting on the role of education in influencing the thoughts, values, and abilities of people, which are important in the quest to sustain the environment (Mammino, 2011; Pivorienė, 2014). ESD does not just educate kids mentally but also teaches them to develop emotionally, morally, and physically and this is vital in such a case as young students learn and acquire values.

Therefore, the research indicates that an increasing number of individuals support the idea that by introducing sustainability to kids early in life, one can indeed make them learn and consider the concept throughout their lives. While pre-service teachers know ESD is important, they also need a more well-rounded and practical way to get the environmental, social, and economic ideas into their lessons. Enhancing teacher training and using more hands-on, practical ways of teaching will be important to help primary schools around the world teach and promote good development practices (Lamanauskas & Malinauskienė, 2024). It follows the main idea of existing ESD competence models that promote the integration of sustainability throughout academics and teaching methods. The models encourage the utilization of an integrated system encompassing the mental, emotional as well as behavioral dimensions of sustainability. Timm and Barth (2020) fill the framework with the perception of teachers, which makes the models rooted in the experience in the classroom. Students find it significant, as it can help to acquire knowledge, skills, attitudes, and values that can assist in achieving sustainability, and ESD is considered a valuable approach to implement this goal globally (United Nations, 2015; UNESCO, 2018). Nonetheless, despite its necessity, ESD is a time-consuming and tedious process that is mostly restricted by the teachers assuming their responsibility to make their classroom lessons more sustainable (Kang, 2019). It would bring more success and delight to schools by comprehending the problems teachers will be forced to overcome to implement an ESD.

Statement of the Problem

ESD is recognized globally as a requirement to enhance sustainable future; the incorporation of ESD in the primary schools is a major challenge. Implementation of the ESD pedagogies is susceptible to barriers such as lack of curricular support, resources and poor training of teachers. When teachers are not prepared well, it should lead to triggering of critical thinking, good social interaction and the capacity to make decent decisions concerning sustainability in students.

Significance of the Study

The research is important as it considers a gap in the current research in the implementation of ESD at primary school levels. The information will prove useful to the policy makers, educators and curriculum developers because they can now have a better idea of how primary educators can implement ESD principles in their teaching activities successfully. It will determine the most important competencies of teachers and how to get around the existing challenges. Furthermore, the study finally gives the insights on how teacher training and curriculum development can be enhanced in order to facilitate sustainable education in primary education level.

Research Objectives

In this study, the following research objectives were applied:

- I. To compare the perception of the teachers concerning the knowledge of ESD and its integration.

2. To investigate the teaching methods that teachers in primary level use to teach Education for Sustainable Development (ESD) in their classes.
3. To determine the skills that the primary teachers need in order to adopt ESD.
4. To examine the challenges faced by teachers in implementing ESD.

Research Questions

The following research questions were addressed in this study:

1. What is the understanding of teachers about the concept of ESD and its integration in the classrooms?
2. What are the competencies required by primary school teachers to effectively implement Education for Sustainable Development (ESD)?
3. **What are the instructional methods employed by teachers at the primary level to implement the Education for Sustainable Development (ESD) in their lessons?**
4. What are the challenges that primary school teachers face in implementing ESD in their teaching practices?

Research Methodology

The current research study's vital objective is to analyse the teachers' competencies in implementing Education for Sustainable Development at the primary level. The researcher adopted a quantitative method, a descriptive research design, to achieve a comprehensive understanding of the analysis of teachers' competencies for the implementation of Education for Sustainable Development at the Primary level. The research employed a structured questionnaire framework involving primary school practitioners from different private institutions of Mardan, and carried out purposive sampling. A questionnaire had been distributed via Google Forms to get individual responses. The target population for this study consisted of 30 teachers of Primary-level practitioners of Danish Public Schools & College Gujar Garhi Mardan, Frontier Model Schools & College Toru Mardan, Ghazali Schools & College Canal Road Katlang Mardan and Oriental Public School Main Campus Mardan. The total sample accounted for thirty primary school teachers. Researchers used purposive sampling techniques to draw samples from the targeted population.

Table I

School's Name	Frequency
Ghazali Schools & College Canal Road Katlang Mardan	5
Frontier Model Schools & College Toru Mardan	5
Danish Public Schools & College Gujar Garhi Mardan	10
Oriental Public School Main Campus Mardan	10
Total	30

Data Analysis and Discussion

The data was analysed in SPSS (Statistical Package for Social Sciences) using several statistical methods. The researcher applies descriptive statistics by means of factors which include Frequency, Percentage and Mean.

Table 2

Demographic Characteristics of the Respondents (Gender) in the Study

Gender	Frequency	Percentage (%)
Male	2	6.6
Female	28	93.3
Total	30	100.0

Table 2 shows that there were 30 instructors. It is seen that about 93.3% (n=28) of the participants were female, while the remaining 6.6% (n=2) of the respondents were male. This shows that a greater part of the participants were female.

Table 3

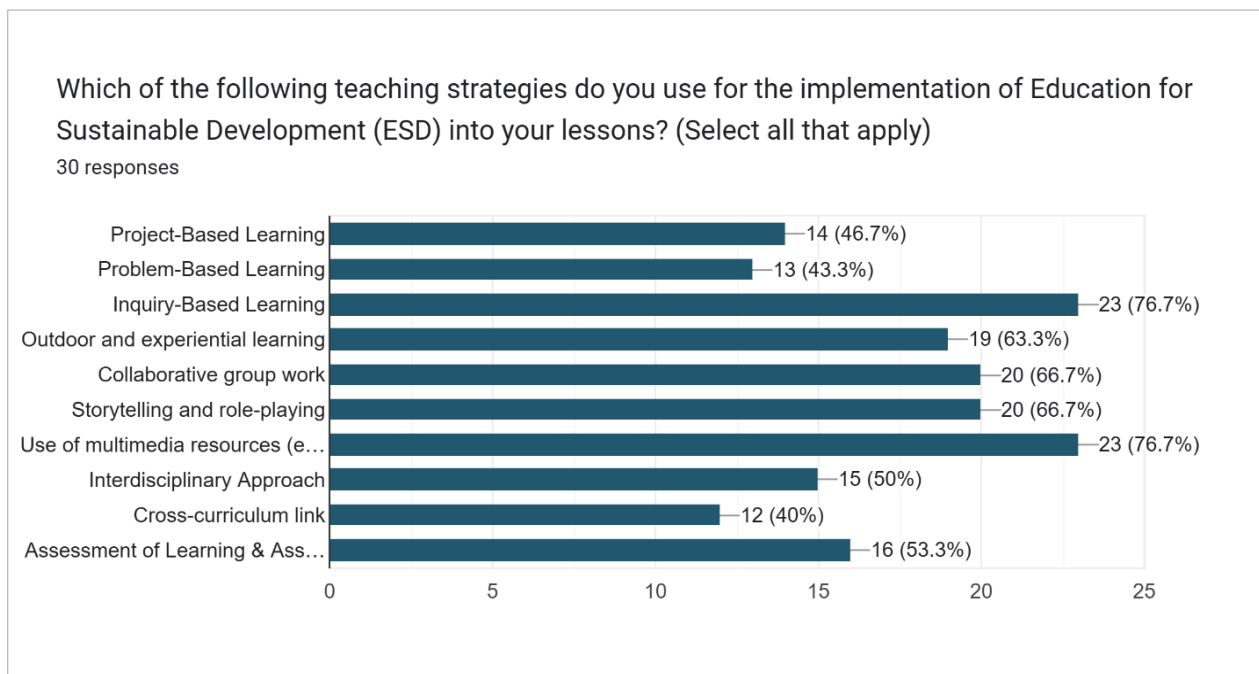
Knowledge and understanding of Education for Sustainable Development (ESD).

Statement	Level	Frequency	Percentage (%)	Mean
I have a strong knowledge and understanding of Education for Sustainable Development (ESD).	SD	0	0	4.07
	D	0	0	
	N	5	16.7	
	A	18	60	
	SA	7	23.3	
	Total	30	100.0	

Table 3 illustrates that 60% (n=18) of respondents agreed with the statement, while 23.3 % (n=7) of respondents strongly agreed with the statement. So, the mean of the data is approximately **4.07**, which indicates that most of the participants agreed with the statement.

Figure I

Which of the Following Teaching Strategies Do You Use for the Implementation of Education for Sustainable Development (ESD) into Your Lessons?



In figure I, participants were requested to choose more than one strategy, out of the list of identified strategies. The most popular was Inquiry-Based Learning and the use of Multimedia resources where 23 respondents (76.7) used each of the media. These findings mean that these strategies are being used extensively by teachers who want to incorporate ESD in their instructional methods.

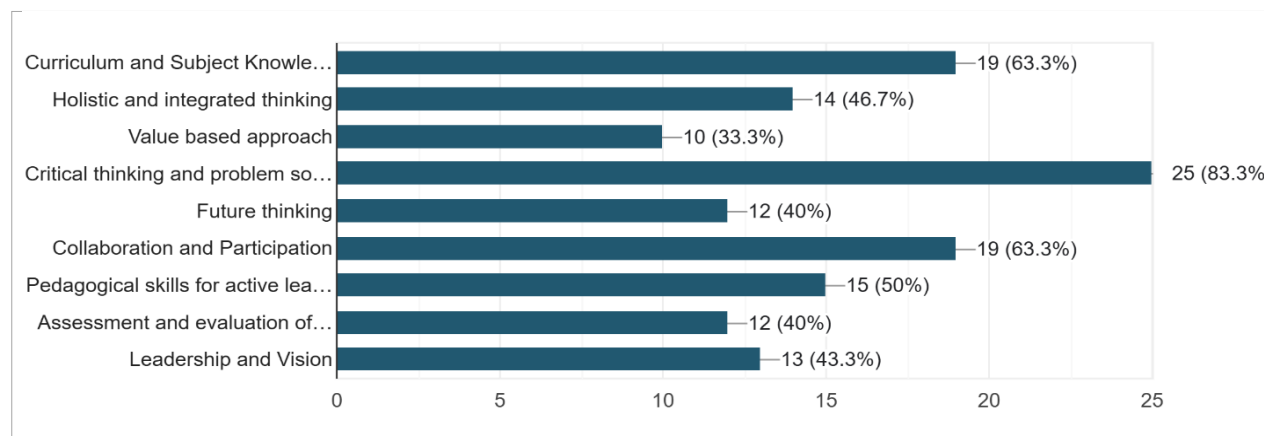
Figure 2*Which Competencies Do You Believe are Required for Effectively Teaching ESD?*

Figure 2 sheds light on the essential abilities that respondents deem necessary for incorporating ESD into their teaching practices. Among the listed competencies, participants were asked to select more than one competency, which indicates that Critical Thinking and Problem Solving stand out as the most valued competencies, with 25 respondents (83.3%) selecting them.

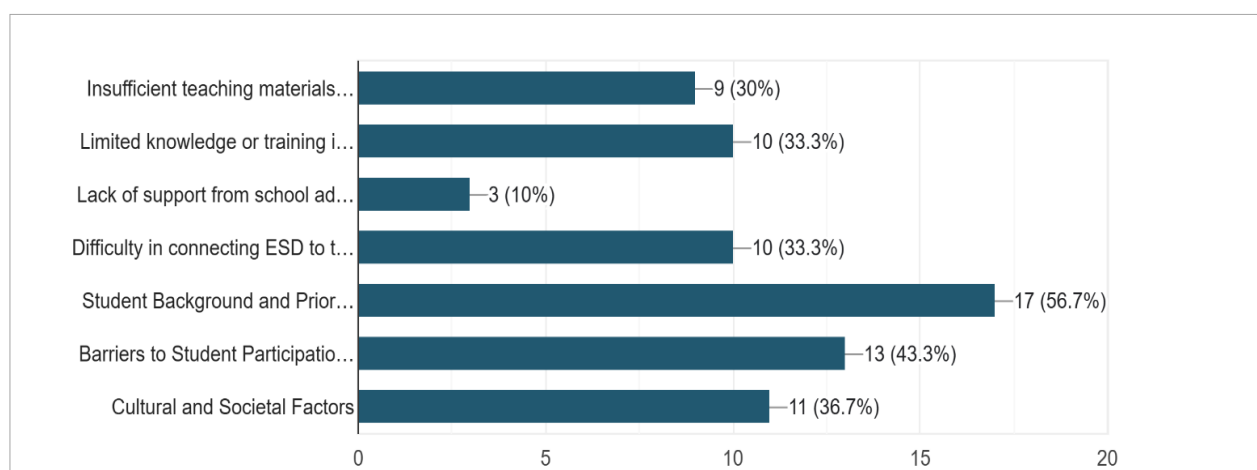
Figure 3*What Challenges Do You Face in Implementing Education for Sustainable Development (ESD) in Your Classroom?*

Figure 3 outlines the challenges that educators face when implementing Education for Sustainable Development (ESD) in their classrooms. The most reported challenge was Student Background and Prior Knowledge, selected by 17 respondents (56.7%). This indicates that many educators feel that students' lack of prior knowledge or the diversity in their educational journey is a problem.

Conclusion

It concludes that the level of understanding of Education for Sustainable Development (ESD) among primary educators is mostly good, and a lot of teachers tend to introduce the topics of ESD in their lessons. Nevertheless, a substantial fraction of educators has not been trained specifically on ESD, and this restricts their level of participation in sustainability actions. Notwithstanding this divide, there is evidence of the dedication to sustainability teaching on the part of teachers, as is manifested in how they teach. The cooperative types of approach, such as Inquiry-Based Learning, multimedia resources, and the works of groups, are normally applied. These are perceived to be interesting and are useful in imparting the concepts of sustainability, and even stories are used as a way of imparting a pragmatic idea. Teachers in primary schools are keen on adopting ESD, yet they are usually limited in their capacity because of the lack of harmony with the curriculum, problems in engaging students and a lack of formal training. Specific training, curriculum changes and institutional support are effective ways of meeting these challenges to enhance the process and influence of ESD in the primary school. The research also talks about the problems of student involvement, particularly

because of unequal background knowledge, cultural distance and lack of involvement. Such are also compounded by our curriculum limitations.

The results reveal that educators are eager, and that this desire must be developed with adequate investment in terms of policies and resources. It will be able to result in a more successful implementation of ESD.

Discussion

The research explored the capabilities of teaching the implementation of Education for Sustainable Development (ESD) in private schools, predominantly in the primary schools. The knowledge level of the teacher concerning ESD is good, and it meets the findings of the past studies that reported the positive attitude of teachers to sustainability education (Tilbury, 2011; UNESCO, 2017). Nevertheless, not all educators have specific ESD training, which also restricts the degree of implementation, giving way to specific professional development (Cebrián & Junyent, 2015). The priorities of teachers are related to critical thinking and the development of problem-solving skills, which are also the global trends concerning the focus on these skills as a means of effective ESD (Kopnina & Meijers, 2014). Yet, a moderate focus is placed on future-oriented leadership as well as value-based education and future thinking, which indicates that holistic competency development might have areas that lack attention (Barth et al., 2015). Inquiry-based learning, multimedia resources and collaborative group work are widely used, as well as the practices, which are known to be the most effective within sustainable education (Wiek et al., 2011). Nevertheless, the applications of interdisciplinary approaches are less prevalent, and this fact has signified the necessity of improved integration of the curriculum (McKeown & Hopkins, 2010). The paper has a very strong sense of the influence of family and moral values in defining the effectiveness of ESD; hence, the sentiment that community and culture contexts are seriously critical in dictating sustainability education results is true (Sterling, 2010). It implies that families and local communities should be engaged in ESD work. Some barriers were determined, including the little background knowledge and motivation by the students, as they are common and are observed in literature (Rickinson, 2001). This indicates the significance of colour instruction and variety of instruction schemes to meet the needs of different learners (Filho et al., 2018).

Recommendations

The recommendations to enhance the education of the Sustainable Development (ESD) in primary schools are based on the results of the research:

- ▶ Regular and targeted professional development programs should help teachers to have appropriate knowledge and feel empowered in relation to ESD.
- ▶ To provide teachers with the support to integrate ESD themes throughout different subjects on a regular basis, the teachers need to be motivated and encouraged to do so with the help of dedicated resources and curriculum guidelines.
- ▶ The family background and moral values have a great influence on ESD, therefore the schools should engage the families and communities in establishing a favorable situation to endure sustainability learning.
- ▶ Other programs like Inquiry Based Learning, Multimedia Resources, Group work and Experiential Learning are already in place. These should be encouraged further through the training of the teachers and the provision of resources.
- ▶ An emphasis on critical thinking, problem solving, knowledge of the curriculum and collaboration should be imparted in training programs in order to become a competent teacher of ESD.
- ▶ Differentiated instruction and motivational strategies should be employed to meet the needs of students with different knowledge levels and to make students interested in the topic of sustainability.
- ▶ Allowing students to contribute to sustainability-related choices will enhance the level of their involvement and make ESD more effective as teachers provide them with the necessary powers.
- ▶ Encouraging teachers and students to have a positive mind towards sustainability will enhance overall effectiveness of ESD work.
- ▶ By enhancing that which is transdisciplinary and the need to ensure learning life-long, it will facilitate effective comprehensive sustainability education in all subjects.
- ▶ This will be achieved through developing partnership with the communities living in the area and this will enhance learning activities and give the learning a real world scenario related to ESD.

References

- Abo-Khalil, A. G. (2024). Integrating sustainability into higher education challenges and opportunities for universities worldwide. *Heliyon*, 10(9), e29946. <https://doi.org/10.1016/j.heliyon.2024.e29946>
- Ärlemalm-Hagsér, E., & Sandberg, A. (2011). Sustainable development in early childhood education: In-service students' comprehension of the concept. *Environmental Education Research*, 17(2), 187–200. <https://doi.org/10.1080/13504622.2010.522704>
- de Haan, G. (2010). The development of ESD-related competencies in supportive institutional frameworks. *International Review of Education*, 56(2-3), 315–328. <https://doi.org/10.1007/s11159-010-9157-9>
- Ferguson, T., Roofe, C., & Cook, L. D. (2021). Teachers' perspectives on sustainable development: The implications for education for sustainable development. *Environmental Education Research*, 1–17. <https://doi.org/10.1080/13504622.2021.1921113>
- Ferguson, T., Roofe, C., Cook, L. D., Bramwell-Lalor, S., & Hordatt Gentles, C. (2022). Education for sustainable development (ESD) infusion into curricula: Influences on students' understandings of sustainable development and ESD. *Brock Education Journal*, 31(2), 63–84. <https://doi.org/10.26522/brocked.v31i2.915>
- Holfelder, A.-K. (2022). Teaching sustainability: A study of teachers and conceptual tensions. *Discourse and Communication for Sustainable Education*, 13(1), 77–87. <https://doi.org/10.2478/dcse-2022-0007>
- Hung, L.-C., & Pan, H.-J. (2025). Innovative approach to ESD integration into school-based curriculum development modules for elementary schools. *Sustainability*, 17(4), 1427. <https://doi.org/10.3390/su17041427>
- Imran, M., Almusharraf, N., & Abdellatif, M. S. (2024). Education for a sustainable future: The impact of environmental education on shaping sustainable values and attitudes among students. *International Journal of Engineering Pedagogy (IJEP)*, 14(6), 155–171. <https://doi.org/10.3991/ijep.v14i6.48659>
- Kioupri, V., & Voulvoulis, N. (2019). Education for sustainable development: A systemic framework for connecting the SDGs to educational outcomes. *Sustainability*, 11(21), 6104. <https://doi.org/10.3390/su11216104>
- Lamanauskas, V., & Malinauskienė, D. (2024). Education for sustainable development in primary school: Understanding, importance, and implementation. *European Journal of Science and Mathematics Education*, 12(3), 356–373. <https://doi.org/10.30935/scimath/14685>
- Manuel, & Davim, J. P. (2019). *Higher education and sustainability*. CRC Press. https://www.researchgate.net/publication/314871233_Education_for_Sustainable_Development_Goals_Learning_Objectives
- Noor Hamwy, Bruder, J., Abdellatif Sellami, & Romanowski, M. H. (2023). Challenges to teachers implementing sustainable development goals frameworks in Qatar. *Sustainability*, 15(15), 11479. <https://doi.org/10.3390/su151511479>
- Pegalajar-Palomino, M. del C., Burgos-García, A., & Martinez-Valdivia, E. (2021). What does education for sustainable development offer in initial teacher training? A systematic review. *Journal of Teacher Education for Sustainability*, 23(1), 99–114. <https://doi.org/10.2478/jtes-2021-0008>
- Rieckmann, M., & Barth, M. (2022). Educators' competence frameworks in education for sustainable development. In *Sustainable development goals series* (pp. 19–26).
- Riess, W., Martin, M., Mischo, C., Kotthoff, H.-G., & Waltner, E.-M. (2022). How can education for sustainable development (ESD) be effectively implemented in teaching and learning? An analysis of educational science recommendations of methods and procedures to promote ESD goals. *Sustainability*, 14(7), 3708. <https://doi.org/10.3390/su14073708>
- UNESCO. (2012). *Education for sustainable development in action: Learning & training tools No. 4*. <https://sustainabledevelopment.un.org/content/documents/926unesco9.pdf>
- Vare, P., Arro, G., de Hamer, A., Gobbo, G. D., de Vries, G., Farioli, F., Kadji-Beltran, C., Kangur, M., Mayer, M., Millican, R., Nijdam, C., Réti, M., & Zachariou, A. (2019). Devising a competence-based training program for educators of sustainable development: Lessons learned. *Sustainability*, 11(7), 1890. <https://doi.org/10.3390/su11071890>