

Beliefs of secondary school teachers towards education for sustainable development: a statistical research

Sijo Varghese, P. M. Mathew

Department of Social Work, CHRIST (Deemed to be University), Bangalore, India

Article Info

Article history:

Received May 13, 2025

Revised Dec 6, 2025

Accepted Feb 1, 2026

Keywords:

Beliefs
Education for sustainable development
Secondary school teachers
Statistical research
Survey

ABSTRACT

Educators are the architects of sustainable development (SD), transforming society and balancing development and sustainability. They enhance education for sustainable development (ESD) and societal transformation, driving innovative evolution and future-oriented development within the community. ESD, a millennium, and sustainable development goal (SDG), need to be implemented globally. Teachers are vital in transmitting knowledge, beliefs, and skills required for sustainability in the changing environment. This study examined secondary school teachers' beliefs about ESD based on their professional qualifications, teaching experience, and position. The authors used a survey approach and collected the data using a belief assessment tool, i.e., the ESD beliefs scale. The respondents were 400 secondary school teachers in Kerala, India. The study used an item-based evaluation to achieve these objectives and calculated t-values, F-values, and percentages. The research findings indicated that teachers hold constructive opinions towards ESD. The positional status of teachers did not alter beliefs regarding ESD among secondary school teachers. In contrast, professional qualifications and years of teaching experience significantly influenced these ESD beliefs. The findings from this study enable education stakeholders to amend the current secondary education system for SD.

This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.



Corresponding Author:

Sijo Varghese
Department of Social Work, CHRIST (Deemed to be University)
Bangalore, 560 029, Karnataka, India
Email: sijo.varghese@res.christuniversity.in

1. INTRODUCTION

A significant component of the 21st century is the transformations across multiple domains, namely ecology, economy, and society, the pillars of sustainable development (SD) [1]. The planet faces unprecedented challenges, including water, air, and soil pollution, light and noise pollution, waste management, climate change, and biodiversity loss, which contribute to elevated health-related mortality rates [2]–[5]. The unscientific fluctuations in the economy create social challenges, such as unemployment and limited access to clean drinking water, sanitation, and other health-related services [6], and a persistent rise in poverty, inequalities, and imbalances in production and consumption, as well as failures in establishing peace and justice, underscoring the imperative for improved quality of life and superior education [7]. Furthermore, the interconnected nature of these issues [8]–[11] emphasizes the need for enhanced education and improved quality of life. Teachers are pivotal in educating others to address these challenges [12] and in promoting social change and equipping learners with 21st-century skills, including a research-oriented mindset, proficient problem-solving, effective communication, digital literacy, a commitment to lifelong learning, critical thinking, and an openness to innovation [13]–[16].

Education for sustainable development (ESD), an indicator of sustainable development goal (SDG4), enhances awareness, decision-making, and sustainable actions [17], [18]. It promotes social transformation through educational initiatives, school gardens, and sustainability certifications to change individual beliefs [19]. The United Nations has asserted that education is essential to SD, as it profoundly influences individual cognition and behavior [20], leading toward a more responsible future generation. Socio-emotional learning linked to sustainable transformation equips higher education to implement sustainable change [21]. There is growing international recognition of ESD as a crucial component of quality education and a strategic driver of SD [22]. In implementing ESD, teachers are pivotal in instilling the knowledge, beliefs, and qualities essential to SD [23], since it is a form of education characterized by a shared understanding of the developmental challenges required to foster future-oriented growth in society [24], [25]. Though ESD has emerged as a concept within higher education [26], it was unfamiliar to professors in environmental education, biological sciences, value education, and faculties in esteemed science, technology, engineering, and mathematics (STEM) disciplines, despite its implications for contemporary conceptual understanding in the dynamic fields of education and its practical applications for societal advancement [27]. Sustainability encompasses significant implications within higher education, including outreach and research, which highlight the skills and talents of ESD [28]. This is an outcome of the fact that emotions regarding sustainability are a significant predictor of ESD [29], and emotional awareness, environmental awareness, and self-efficacy play critical roles in preserving sustainability in the education curriculum [30].

Although sustainability debates are accepted in higher education, teachers need to be trained to teach ESD and to live sustainably [23], [31], [32]. Sustainability should be integrated into all educational domains, not just specific courses or programs that have short-term consequences and lack ESD knowledge, skills, values, and involvement [33], [34]. It should be introduced in all forms of education, from kindergarten to higher education [35]. Sustainable structures must be strengthened to enhance the quality of human resources, pedagogical understanding, knowledge management, and self-leadership in preschool leadership [36]. Moreover, future teachers need to reveal their willingness to promote SD, as they are among the most influential in preparing tomorrow's leaders to ensure a sustainable future [37]. It was frequently observed that teachers' awareness of the importance of incorporating SD into their curricula is not prioritized, a situation that must be rectified immediately [38]. Teachers ensure that students acquire values, knowledge, and skills early for sustainability [39], [40].

However, sustainability education is often framed in an evolutionary context, which threatens natural resources, undermines social security, and leaves teachers feeling conflicted [41]. SD, which addresses global sustainability challenges through outcome-oriented educational interventions, is considered along with development and global citizenship education [42]. ESD elucidates the connection between SD challenges and the cultivation of viewpoints and values among individuals across all demographics, encouraging voluntary commitment to establishing a sustainable future [43]. Despite ESD guidelines implemented through policies and programs, a disconnect persists between empirical studies and individuals' intuitive perceptions of these issues [44]. To promote ESD, high school teachers in the state should assess their beliefs towards ESD and support its implementation through a well-organized curriculum, well-designed teaching resources, and well-defined teaching methods [23].

In recent years, there have been ongoing discussions about implementing ESD programs [45]. The current National Education Policy (NEP) 2020 implemented by the Government of India envisions cultivating knowledge, skills, beliefs, and dispositions that enable responsible commitment to human rights, SD and living, and global well-being, reflecting a genuinely global citizen [46]–[48]. The policy encourages numerous educational stakeholders to adopt the Indian way of thinking and achieve SD and a better quality of life [49]. At this juncture, educators must possess knowledge and competencies related to SD practices and incorporate them into their professional domains. While there are several studies on high school teachers' views towards ESD, no empirical research has been conducted on secondary school teachers, who comprise those in 8th to 12th grade, regarding their beliefs regarding ESD in Kerala. Understanding how secondary school teachers in the state feel about ESD is essential for progress, but it must be done from a wide range of perspectives. For this examination, the researchers developed the following research questions:

- i) What are the beliefs of secondary school teachers about ESD?
- ii) How relevant are their professional qualifications to their beliefs on ESD?
- iii) How might secondary school teachers' beliefs on SD change in light of their positional status?
- iv) What implications does the difference in their teaching experiences have on their beliefs towards SD?

Based on these questions, the authors aim to assess, enhance, and elevate educators' beliefs about education for SD, ascertain the degree of sustainability statistically, and offer guidelines for advancing modern methodologies.

2. METHOD

The research employed an empirical survey to elucidate secondary school educators' beliefs regarding ESD. The study's criterion variable was the ESD belief scale, and the demographic variables included teachers' professional qualifications, position, and years of classroom experience to determine secondary school teachers' beliefs. The authors affiliated institution's Research Conduct and Ethics Committee approved ethical clearance for the study under Certificate Number CU: RCEC/00243/08/24, dated 3 September 2024. The study population consisted of secondary school teachers in Kerala, India, teaching grades 8 to 12 under the state syllabus, excluding those who teach the Central Board of Secondary Education (CBSE) and Indian Certificate of Secondary Education (ICSE) curricula. The teachers completed a Google Form questionnaire using social media platforms, including email and WhatsApp. The 422 teachers responded to the questionnaire, and the authors excluded 22 for failing to meet the state syllabus's inclusion requirements.

Thus, the study group consisted of 400 secondary school educators from various schools in Kerala who participated in the survey voluntarily and with free consent. This study employed purposive sampling to ensure adequate representation of professional qualifications, positional status, and teaching experience. The software the authors used for data analysis was SPSS 29. Table 1 outlines the socio-demographic and professional backgrounds of the study cohort. According to Table 1, 77% (307) of secondary school teachers possess a master's degree, 17% (71) hold a bachelor's degree, and 6% (22) have an MPhil or doctoral degree. A total of 52.75% (211) of secondary school teachers are high school teachers. A total of 40.5% (162) are teachers at the higher secondary level. A total of 6.75% (27) of the teachers are secondary school teachers holding administrative roles such as HM or principal. Furthermore, 33.25% (133) of secondary school teachers have 21 to 26 years of experience and are classified as senior teachers.

The "ESD belief scale", which was slightly modified from the original and developed by Sağdıç and Şahin [50], was used as the measurement instrument in this research. The authors administered the measuring instrument to twenty secondary school teachers to validate that they satisfactorily addressed the research problem. The scale ranges from "strongly disagree" to "strongly agree", with five possible responses. A score of '1' indicates strong disagreement, '2' is disagree, '3' is neutral, '4' is agree, and '5' is highly agree. The objective of this questionnaire was to determine the preferred educational methods for teachers to promote ESD empowerment. The proper dimensions for assessing the beliefs of secondary school teachers towards ESD were identified based on Scoullos and Malotidi [51] and the research paper by Ko and Lee [52]. Three options were given to examine the ESD beliefs: "beliefs regarding the difficulty of implementing SD" and "beliefs concerning the appropriateness of ESD within the education system". With a Cronbach's alpha reliability coefficient of 0.941, the ESD belief scale appears to be a valid tool for assessing secondary school educators' beliefs and perspectives on ESD.

Table 1. Demographic profile of the study group

Parameters	Category	Number of educators	Percentage (%)
Professional qualifications	Bachelor degree	71	17
	Master's degree	307	77
	MPhil degree	18	5
	Doctoral degree	4	1
Status of position	High school assistant	211	52.75
	Head master/mistress	14	3.50
	Higher secondary school teacher	162	40.50
	Principal	13	3.25
Teaching experience	Below 11 years	103	25.75
	11 to 16 years	74	18.50
	16 to 21 years	63	15.75
	21 to 26 years	133	33.25
	26 to 31 years	26	6.50
	31 to 36 years	1	0.25
Total		400	100

3. RESULTS

The study employed item-based evaluation, descriptive statistics, and percentage analysis to assess the responses to the teachers' belief scale. The research employed inferential statistics, including the independent samples t-test, ANOVA, and percentages, to identify differences in beliefs across sub-samples using the Kruskal-Wallis's test. The value of 0.05 for the alpha criterion was established for statistical significance. An itemized assessment evaluated secondary school teachers' beliefs about ESD. This study examined the proportion of belief in ESD among secondary school teachers across three dimensions: ease of

implementation, difficulty, and appropriateness. The information is displayed in Tables 2-4, respectively. Table 2 presents an analysis of secondary school teachers' beliefs regarding ESD. Over 90% believe ESD can enhance students' decision-making skills. Notably, 95.75% advocate for teachers to help children relate their experiences to current environmental and developmental issues. Approximately 94.25% of teachers noted that ESD provides relevant knowledge, values, and skills for everyday life. Additionally, 95.5% highlighted the significance of student participation and teamwork in learning, while 92.5% support student involvement in sustainability projects at both local and global levels.

Table 2. Secondary school teachers' beliefs about the ease of implementing ESD

SL No	Statements	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Mean±SD
1.	ESD improves students' future decision-making skills.	2	1	7	69	21	4.06±0.71
2.	Incorporating lessons on contentious economic, developmental, and environmental topics helps pupils develop their critical thinking abilities.	2	3	9	72	14	3.91±0.73
3.	Integrating SD into their lessons enhances teachers' professional skills.	1	2	13	73	11	3.91±0.62
4.	Students can enhance their comprehension of the subject while teaching SD.	1	2	10	74	13	3.97±0.60
5.	Students can enhance their meaningful learning by participation and collaboration in the classroom.	1	1	3	66	29	4.23±0.62
6.	The principles, values, and information imparted by ESD programs apply to all life aspects.	1	0	5	72	22	4.14±0.60
7.	All tiers of schooling ought to incorporate ESD.	1	3	11	71	14	3.93±0.68
8.	Topics relevant to students' everyday lives are the best for teachers.	1	5	11	65	18	3.95±0.74
9.	Teachers should use the teaching resources they have in their everyday lives as part of ESD.	0	2	9	76	13	4.00±0.54
10.	Schools, public, and private sectors should collaborate to promote SD.	0	3	12	75	10	3.91±0.59
11.	When developing ESD, it is important to consider my country's cultural and social context.	0	1	10	79	10	3.99±0.49
12.	Every academic course should prioritize ESD.	0	1	11	77	11	3.99±0.52
13.	All teachers should consider ESD.	0	1	10	77	12	3.99±0.53
14.	Students must possess the right to propose and determine ESD issues.	0	2	10	79	9	3.94±0.53
15.	Teachers should motivate pupils to forge a link between their personal experiences and global environmental and developmental challenges.	0	1	4	80	15	4.11±0.46
16.	As part of ESD, it is important to inform children about current events using print and visual media.	0	1	7	76	16	4.07±0.52
17.	Sustainability initiatives, both local and global, should encourage student participation.	0	1	7	80	12	4.04±0.48
18.	Role-play and debates are useful methods for learning SD.	0	1	10	74	15	4.03±0.54
19.	Since there is much material in ESD, students should choose their study area.	0	5	19	72	4	3.74±0.62
20.	Allowing students to engage in open dialogue regarding the subjects is an advantageous approach to ESD.	0	1	9	80	10	3.99±0.48
21.	Teachers in all subjects must know how to include SD in their lessons.	0	2	9	76	13	3.99±0.58

Table 3. Secondary school teachers' beliefs about the difficulty of implementing ESD

SL No	Statements	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Mean±SD
1.	In secondary education, sustainability is too contentious to be taught.	5	33	25	33	4	3.01±1.00
2.	An impractical method of teaching is ESD.	8	61	17	13	1	3.65±0.83
3.	Lessening student motivation is the result of incorporating SD into secondary education curricula.	9	63	13	13	2	3.64±0.91
4.	My academic field has a hard time incorporating ESD.	8	54	21	16	1	3.53±0.87
5.	It is challenging for students to grasp ESD issues.	7	55	17	21	0	3.47±0.90
6.	Implementation of ESD is difficult	6	56	17	20	1	3.46±0.91
7.	There is a loss of productive time when educators include ESD in their classroom practices.	10	65	15	9	1	3.75±0.77

While Tables 2 and 3 outline the components of ESD implementation, the majority of teachers expressed disagreement with several common beliefs: 72% rejected the notion that including sustainability in secondary school curricula demotivates students, and 75% disagreed that integrating ESD into their classes is

Beliefs of secondary school teachers towards education for sustainable development: ... (Sijo Varghese)

a waste of time. Additionally, 69% opposed the belief that ESD is impractical. However, over 62% reported challenges, including difficulties in implementing ESD, understanding ESD topics among students, and incorporating ESD across various academic disciplines. Moreover, 58% of educators considered textbook ESD activities insufficient. Overall, teachers generally feel uninformed about ESD and believe the secondary school curricula and lessons fall short in conveying the significance of SD to students. The study used descriptive statistics, including median, mode, mean, standard deviation, and range, to assess data normality and evaluate secondary school professionals' beliefs regarding ESD.

Table 4. Secondary school teachers' beliefs regarding the appropriateness of implementing ESD

SL No	Statements	Strongly disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly agree (%)	Mean±SD
1.	Students can better understand SD through their secondary school education.	4	49	19	27	1	2.73±0.95
2.	Textbook activities are sufficient for ESD.	1	20	21	55	3	3.40±0.87
3.	The educational curriculum adequately incorporates ESD.	3	37	26	33	1	2.93±0.92
4.	Regarding ESD, school teachers have sufficient knowledge.	2	46	22	29	1	2.79±0.92

Table 5 shows that the total number of samples is 400, with the mean, median, and mode at 120.25, 120.50, and 124, respectively. The standard deviation and variance of the overall beliefs score are 22.021 and 484.924, respectively. The distribution is symmetrical and follows a normal distribution. The obtained scores facilitated the classification of the complete sample into high, moderate, and low groups. The study employed the standard deviation distance from the mean "M" to evaluate the strength of beliefs regarding ESD. Teachers who score (M+1 SD) or above are considered high, while those whose scores are (M-1 SD) or lower are considered low. A typical set of results falls somewhere between these two extremes. Regarding overall beliefs, the mean is 113.53, and the standard deviation is 22.021. The belief is considered substantial if the score is more than M+SD (135.551), moderate if it is between M-SD and M+SD (91.509 and 135.551), and low if it is less than M-SD (91.509). With a score ranging from 91.509 to 135.551, the sample's average belief is 113.53. Figure 1 shows that secondary school professionals have a moderate attitude towards ESD.

Table 5. Descriptive statistics of the variable—beliefs towards ESD

Descriptive statistics	
N	400
Mean	120.25
Median	120.50
Mode	124.00
Standard deviation	22.021
Variance	484.924

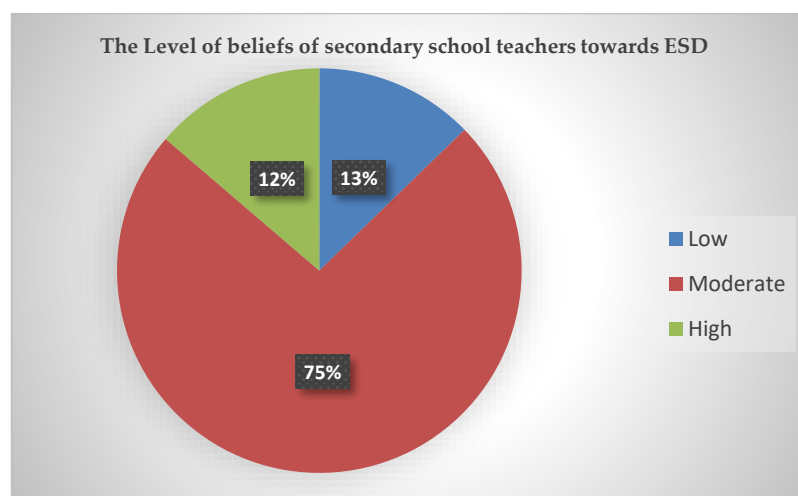


Figure 1. Level of beliefs of secondary school teachers towards ESD

Figure 1 reveals the beliefs of secondary school teachers. The graph indicates that 13% of secondary school teachers possess a low belief, 75% (N=301) have a moderate belief in ESD, and 12% have a firm belief. Based on the evaluation of research question 2, which aimed to analyze beliefs about ESD in relation to professional degrees, the study employed an independent-samples F-test. The dependent variable, beliefs towards ESD, is measured at the interval level and is approximately normal. The independent variable varies by level of graduation. It has three categories: a bachelor's degree, a postgraduate degree, and an MPhil or a doctorate. The sample size is substantial and satisfies the criteria for the independent F-test. The variances among the three groups being compared are highly significant ($p=0.002<0.05$), indicating that knowledge of ESD varies dramatically by professional qualifications. Post hoc testing revealed that undergraduate-level teachers understand ESD less than their counterparts. The analysis results are presented in Table 6.

Table 6. Secondary school teachers' beliefs about ESD by professional qualifications

Professional qualifications	N	Mean	Standard deviation	Calculated F-value	p-value	Remarks
Bachelor degree	71	117.2	8.8	12.332	0.002	Significant
Master's degree	307	121.52	10.5			
MPhil/PhD degree	22	117.5	13.4			

Of the teaching professionals listed in Table 6, 71 hold undergraduate degrees, 307 hold master's degrees, and 22 hold doctorates. The performance scores indicated that teachers with bachelor's degrees averaged 117.2 (SD=8.8), while those with master's degrees averaged 121.52 (SD=10.5). In contrast, the MPhil or doctorate holders scored an average of 117.5 (SD=13.4). A significant statistical difference was observed ($p\text{-value}=0.002$), indicating that educational qualifications indeed affect beliefs about ESD. The results favor rejecting the null hypothesis, demonstrating distinct attitudes towards ESD by degree level. Notably, master's degree teachers exhibited the most positive attitudes towards ESD, while variance was particularly high among the MPhil/doctorate group. This suggests that academic qualifications directly influence beliefs about ESD, with variations in perspective evident across the education levels assessed.

Table 7 shows that of the 400 sampled teachers, 211 were from high schools, 162 from higher secondary schools, and 27 held administrative roles across both. Administrative teachers were excluded due to their limited numbers. The average score for high school teachers was 119.91 (SD=10.298), while that for higher secondary school educators was 120.46 (SD=10.736). A p-value of 0.463, exceeding the significance threshold of 0.05, indicates no statistically significant difference in beliefs about ESD based on teaching position. This suggests that high school and secondary school teachers held similar views, with secondary school teachers expressing slightly more favorable beliefs. Both groups showed comparable standard deviations, indicating similar belief distributions. The hypothesis proposed that teachers' beliefs regarding ESD did not differ significantly by status, as evidenced by a minimal mean difference of 0.55 points, confirming that teaching position had a negligible impact on these beliefs.

Table 7. Secondary school teachers' beliefs towards ESD based on their status and position

Status of position	N*	Mean	Standard deviation	Calculated t-value	p-value	Remarks
High school assistant	211	119.91	10.298	0.733	0.463	Not significant
Higher secondary school teacher	162	120.46	10.736			

*Teachers with administrative positions like HM and principals were very few in the sample; hence, the study did not include them in this comparison.

Table 8 presents the distribution of teaching experience among 400 teachers, revealing that 103 had 6 to 11 years, 74 had 11 to 16 years, 63 had 16 to 21 years, 133 had 21 to 26 years, and 27 had over 26 years of experience. The analysis of test scores shows that the 16- to 21-year-old cohort has the highest mean score of 122.94 (SD=11.49), followed closely by the 26+ cohort at 122.52 (SD=9.72). Conversely, teachers with 11 to 16 years had the lowest mean of 118.28 (SD=8.84), while those with 6 to 11 years scored a mean of 118.62 (SD=10.62). A statistically significant difference was found ($p\text{-value}=0.011$), leading to rejection of the null hypothesis. This suggests that teachers' beliefs regarding ESD differ significantly with experience, notably improving after 16 years, while those with less experience displayed less favorable views. The consistent standard deviations suggest similar variability in scores across experience groups.

This study generated highly significant results about ESD. A total of 90% of the teachers believed ESD can enhance students' future decision-making abilities. In addition, 72% of teachers disagreed with the assertion that incorporating ESD into the curriculum diminishes student motivation. Up to 58% of teachers contended that textbook activities are inadequate for ESD. Conversely, the study reveals a highly significant finding that secondary school teachers have strong positive beliefs towards ESD. Secondary school teachers

constitute a diverse segment of the educational community, and 75% strongly believe in ESD. The comparison of secondary school teachers' beliefs based on their professional qualifications revealed considerable differences in their mean scores. Teachers with extensive experience exhibited a significant difference in their mean scores regarding beliefs about ESD. When comparing teachers across positions and statuses regarding their beliefs about ESD, the study found no differences.

Table 8. Secondary school teachers' beliefs towards ESD based on teaching experience

Teaching experience in years	N	Mean	Standard deviation	Calculated F-value	p-value	Remarks
6 years to 11 years	103	118.62	10.62	13.09	0.011	Significant
11 years to 16 years	74	118.28	8.84			
16 years to 21 years	63	122.94	11.49			
21 years to 26 years	133	120.86	10.71			
26 years and above	27	122.52	9.72			

4. DISCUSSION

The current study examined the beliefs of 400 teachers in the sample and their associated variables regarding ESD. Teachers are warmly receiving the incorporation of ESD into the curriculum [24], [25], [53]. According to this study, 300 out of 400 teachers hold favorable opinions about ESD, despite certain constraints and difficulties associated with its implementation, as in Figure 1. According to the study, belief changes should be considered a crucial component of ESD. Beliefs are subject to change in response to new information because they are subjective. At different stages of their teacher education programs, ESD is impacting teacher education [54]. This is significant with secondary school teachers' professional qualifications and beliefs regarding ESD, as indicated in Table 6. However, teacher education systems should work more diligently to ensure that aspiring teachers are prepared to teach and encouraged to have a positive outlook on ESD. Additionally, under a departmental mandate, teachers currently employed in education can receive training as part of their ongoing professional development [15]. This could improve their teaching and learning processes and help them achieve the SDGs of the 2030 Agenda.

The study reveals that teachers generally hold optimistic beliefs about ESD, which are crucial to its successful implementation in the curriculum [24]. A significant shift in these beliefs is identified as a foundational element of ESD. The findings align with government efforts to enhance sustainability-related activities in education, indicating that integrating ESD can help prevent pollution, protect biodiversity, and reduce deforestation. It is emphasized that sustainability principles must be embedded within teacher education programs, as teachers play a pivotal role in influencing societal change through their knowledge dissemination. Although teachers possess moderate beliefs about ESD, fostering a more holistic approach in teacher training is essential to bolster their confidence and preparedness. Teacher education initiatives should prioritize an integrated curriculum that encompasses ESD across various disciplines while also promoting a positive disposition towards sustainability among teachers and students. The study highlights the ongoing challenges of aligning international sustainability commitments with local educational practices and advocates for legislative support to embed ESD comprehensively across educational frameworks [23], [28].

According to the findings, teachers with higher educational backgrounds and cumulative teaching experience upgraded their ESD beliefs more than those with hierarchical status, incorporating critical thinking, research skills, and contemporary educational philosophies, and developing more profound and comprehensive sustainability beliefs than in previous studies. Specialized courses or research may have improved sustainability or ESD knowledge. Additionally, experienced teachers noted changes in pedagogical priorities and increased opportunities for ESD application and reflection. This encounter enhances their belief in ESD's importance and impact. The teacher level or administrative position did not affect their sustainability attitudes because they often shared similar professional values and educational philosophies, especially when working within the same educational culture or policy framework. Professional development programs that target secondary school teachers' academic levels and years of experience, rather than job titles or positions, have been shown to improve ESD beliefs. In contrast to prior studies, highly qualified and experienced secondary school teachers exhibit confidence in implementing ESD [15], [23].

The study suggests that all teachers should participate in projects focusing on SD and the environment to gain a comprehensive understanding of environmental sustainability. The 2030 agenda on ESD provides a systemic approach to sustainability, which could lead to a paradigm shift in sustainable practices [55]. The study recommends modifications to the curriculum, such as different pedagogies for a society with access to artificial intelligence, government support for ESD teacher training in secondary education, and an update to the secondary school curriculum to reflect real-world implications of SD.

Teacher preparation programs should undergo a radical makeover, focusing on sustainability and the future. Future teachers should receive training in teaching SD effectively to meet societal demands [56].

The research indicates that secondary school teachers in Kerala generally hold positive beliefs towards ESD, with 75% exhibiting moderate attitudes. This insight supports enhancements in teacher training and policy implementation under the NEP 2020, which focuses on developing environmentally aware citizens. The influence of teachers' qualifications and experience on ESD beliefs underscores the need for tailored training programs to enhance understanding and teaching strategies for sustainability. Furthermore, gaps in textbook activities and curriculum suggest a mismatch between policy goals and classroom practices. NEP 2020 advocates for flexible, competency-based education, highlighting the need for enriched textbooks and whole-school sustainability practices. The findings underscore the importance of universal ESD training for all teachers, aligning with the vision of NEP 2020 [46], [49] for holistic development and global citizenship, ultimately aiding in achieving India's SDG 4.7 targets.

5. CONCLUSION

The research on secondary school teachers' beliefs regarding ESD highlights a significant positive disposition towards ESD implementation through organized curricula, tailored resources, and defined instructional strategies. Concentrating on a sample of secondary school teachers in Kerala, India, the study indicates no significant differences in beliefs by positional status. However, there are notable variations in teachers' professional qualifications and teaching experience. While most teachers take a constructive stance on ESD, some exhibit confusion, ignorance of sustainability-fostering methodologies, or uncertainty about how to achieve societal change. The research is limited to a single geographical context, which may limit understanding of teachers' beliefs across different regions or grade levels. Consequently, future research is encouraged to include primary school teachers and to conduct longitudinal studies to deepen secondary school teachers' understanding of ESD. The study advocates targeted ESD-focused interventions for teacher professional development and calls for curriculum adjustments to effectively incorporate ESD principles, offering crucial insights for educational stakeholders seeking to enhance ESD strategies.

ACKNOWLEDGMENTS

The authors acknowledge the study participants' cooperation and support, as well as the technical assistance provided.

FUNDING INFORMATION

The authors state no funding is involved.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Sijo Varghese	✓	✓	✓	✓	✓	✓		✓	✓	✓				✓
P. M. Mathew		✓		✓		✓		✓	✓	✓	✓	✓		

C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nvestigation

R : **R**esources

D : **D**ata Curation

O : Writing - **O**riginal Draft

E : Writing - Review & **E**ditng

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

INFORMED CONSENT

We have obtained informed consent from all participants included in this study.

ETHICAL APPROVAL

The study was conducted in accordance with the Declaration of Helsinki and approved by the Authors' Institutional Review Board (certificate number CU: RCEC00243/08/24, dated September 3rd, 2024).

DATA AVAILABILITY




Data are contained within the article.

REFERENCES




- [1] S. Nate, Y. Bilan, D. Cherevatskyi, G. Kharlamova, O. Lyakh, and A. Wosiak, "The impact of energy consumption on the three pillars of sustainable development," *Energies*, vol. 14, no. 5, p. 1372, Mar. 2021, doi: 10.3390/en14051372.
- [2] S. Varghese, "Environmental and sustainable development policies to address the pollution catastrophe in India," *Asian Journal of Water, Environment and Pollution*, vol. 21, no. 3, pp. 45–52, Jan. 2024, doi: 10.3233/AJW240033.
- [3] S. Varghese and K. Hemalatha, "Were the recent air pollution and landfill fires in Brahmaputra at odds with Kerala's vision of sustainable development?" *Present Environment and Sustainable Development*, vol. 18, no. 1, pp. 219–233, 2024, doi: 10.47743/pesd2024181016.
- [4] M. Adnan *et al.*, "Prospecting the engineered environmental carbon sinks and ensuring long-term sustainability of karst areas impacted by heavy metal," *Sustainable Horizons*, vol. 14, p. 100126, Jun. 2025, doi: 10.1016/j.horiz.2024.100126.
- [5] H. R. Hungerford, "Environmental education (EE) for the 21st century: where have we been? Where are we now? Where are we headed?" *The Journal of Environmental Education*, vol. 41, no. 1, pp. 1–6, Oct. 2009, doi: 10.1080/00958960903206773.
- [6] A. Ali and H. Ur Rehman, "Macroeconomic instability and its impact on gross domestic product: an empirical analysis of Pakistan," *Munich Personal RePEc Archive*, vol. 53, no. 2, pp. 285–316, 2015.
- [7] E. Sinakou, J. B.-de Pauw, M. Goossens, and P. Van Petegem, "Academics in the field of education for sustainable development: their conceptions of sustainable development," *Journal of Cleaner Production*, vol. 184, pp. 321–332, May 2018, doi: 10.1016/j.jclepro.2018.02.279.
- [8] G. Wuelsner, C. Pohl, and G. H. Hadorn, "Structuring complexity for tailoring research contributions to sustainable development: a framework," *Sustainability Science*, vol. 7, no. 1, pp. 81–93, Jan. 2012, doi: 10.1007/s11625-011-0143-3.
- [9] G. Corney and A. Reid, "Student teachers' learning about subject matter and pedagogy in education for sustainable development," *Environmental Education Research*, vol. 13, no. 1, pp. 33–54, Feb. 2007, doi: 10.1080/13504620601122632.
- [10] B. Giddings, B. Hopwood, and G. O'Brien, "Environment, economy and society: fitting them together into sustainable development," *Sustainable Development*, vol. 10, no. 4, pp. 187–196, Nov. 2002, doi: 10.1002/sd.199.
- [11] A. E. J. Wals, "Learning our way to sustainability," *Journal of Education for Sustainable Development*, vol. 5, no. 2, pp. 177–186, Sep. 2011, doi: 10.1177/097340821100500208.
- [12] P. Hallinger and V. T. Nguyen, "Mapping the landscape and structure of research on education for sustainable development: a bibliometric review," *Sustainability*, vol. 12, no. 5, p. 1947, Mar. 2020, doi: 10.3390/su12051947.
- [13] A. Nousheen, S. A. Y. Zai, M. Waseem, and S. A. Khan, "Education for sustainable development (ESD): effects of sustainability education on pre-service teachers' attitude towards sustainable development (SD)," *Journal of Cleaner Production*, vol. 250, p. 119537, Mar. 2020, doi: 10.1016/j.jclepro.2019.119537.
- [14] L. Bürgener and M. Barth, "Sustainability competencies in teacher education: making teacher education count in everyday school practice," *Journal of Cleaner Production*, vol. 174, pp. 821–826, Feb. 2018, doi: 10.1016/j.jclepro.2017.10.263.
- [15] J. Ferreira, L. Ryan, and D. Tilbury, "Mainstreaming education for sustainable development in initial teacher education in Australia: a review of existing professional development models," *Journal of Education for Teaching*, vol. 33, no. 2, pp. 225–239, May 2007, doi: 10.1080/02607470701259515.
- [16] K. Swargiary, *The evolving role of teachers*. Cambridge, MA: LAP LAMBERT Academic Publishing, 2023.
- [17] R. Laurie, Y. Nonoyama-Tarumi, R. McKeown, and C. Hopkins, "Contributions of education for sustainable development (ESD) to quality education: a synthesis of research," *Journal of Education for Sustainable Development*, vol. 10, no. 2, pp. 226–242, Sep. 2016, doi: 10.1177/0973408216661442.
- [18] M. J. Pigozzi, "Quality in education defines ESD," *Journal of Education for Sustainable Development*, vol. 1, no. 1, pp. 27–35, Mar. 2007, doi: 10.1177/097340820700100108.
- [19] K. van Poeck, A. König, and A. E. J. Wals, "Environmental and sustainability education in the Benelux countries: research, policy and practices at the intersection of education and societal transformation," *Environmental Education Research*, vol. 24, no. 9, pp. 1234–1249, Sep. 2018, doi: 10.1080/13504622.2018.1477121.
- [20] I. Bokova, "Why education is the key to sustainable development," World Economic Forum, 2015. Accessed Feb. 13, 2025. [Online]. Available: <https://www.weforum.org/stories/2015/05/why-education-is-the-key-to-sustainable-development/>
- [21] J. Dlouhá, R. Heras, I. Mulà, F. P. Salgado, and L. Henderson, "Competences to address SDGs in higher education—a reflection on the equilibrium between systemic and personal approaches to achieve transformative action," *Sustainability*, vol. 11, no. 13, p. 3664, Jul. 2019, doi: 10.3390/su11133664.
- [22] K. Thiyagu and V. P. Joshith, "Pedagogical and technical intricacies confronted by the pre-service teachers during the virtual internship," *Review of International Geographical Education (RIGEO)*, vol. 11, no. 7, pp. 3501–3511, 2021, doi: 10.48047/rigeo.11.07.320.
- [23] A. Bazilova, K. Kaimuldinova, N. Shakirova, B. Abdimanapov, D. Aliaskarov, and A. Satybaldieva, "Implementation of ESD in school geography: bibliometric analysis of 2015–2024 publications in scientific databases," *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 21, no. 4, pp. 1–17, 2025, doi: 10.29333/ejmste/16169.
- [24] E. O. Anyolo, S. Kärkkäinen, and T. Keinonen, "Implementing education for sustainable development in Namibia: school teachers' perceptions and teaching practices," *Journal of Teacher Education for Sustainability*, vol. 20, no. 1, pp. 64–81, Jun. 2018, doi: 10.2478/jtes-2018-0004.
- [25] M. Perkasa, M. Irwansyah, N. Annafi, Khairunnisa, and Jaharudin, "Teacher's perception on the implementation of education for sustainable development-based learning in senior high school," *Journal of Physics: Conference Series*, vol. 1521, no. 4, p. 042110, Mar. 2020, doi: 10.1088/1742-6596/1521/4/042110.

- [26] L. Măță, O. Clipa, and K. Tzafilkou, "The development and validation of a scale to measure university teachers' attitude towards ethical use of information technology for a sustainable education," *Sustainability*, vol. 12, no. 15, p. 6268, Aug. 2020, doi: 10.3390/su12156268.
- [27] B. Wahono and C. Y. Chang, "Assessing teacher's attitude, knowledge, and application (AKA) on STEM: an effort to foster the sustainable development of stem education," *Sustainability*, vol. 11, no. 4, p. 950, Feb. 2019, doi: 10.3390/su11040950.
- [28] G. Cebrián and M. Junyent, "Competencies in education for sustainable development: exploring the student teachers' views," *Sustainability*, vol. 7, no. 3, pp. 2768–2786, Mar. 2015, doi: 10.3390/su7032768.
- [29] J. Grund and A. Brock, "Education for sustainable development in Germany: not just desired but also effective for transformative action," *Sustainability*, vol. 12, no. 7, p. 2838, Apr. 2020, doi: 10.3390/su12072838.
- [30] G. Martínez-Borreguero, J. Maestre-Jiménez, M. Mateos-Núñez, and F. L. Naranjo-Correa, "Analysis of environmental awareness, emotions, and level of self-efficacy of teachers in training within the framework of waste for the achievement of sustainable development," *Sustainability*, vol. 12, no. 6, p. 2563, Mar. 2020, doi: 10.3390/su12062563.
- [31] H. J. Park and J. S. Cho, "The influence of information security technostress on the job satisfaction of employees," *Journal of Business and Retail Management Research*, vol. 11, no. 1, pp. 66–75, 2016.
- [32] E. Sinakou, V. Donche, J. B. De Pauw, and P. van Petegem, "Designing powerful learning environments in education for sustainable development: a conceptual framework," *Sustainability*, vol. 11, no. 21, p. 5994, 2019, doi: 10.3390/su11215994.
- [33] M. Summers, A. Childs, and G. Corney, "Education for sustainable development in initial teacher training: issues for interdisciplinary collaboration," *Environmental Education Research*, vol. 11, no. 5, pp. 623–647, 2005, doi: 10.1080/13504620500169841.
- [34] L. Velazquez, N. Munguia, and M. Sanchez, "Deterring sustainability in higher education institutions," *International Journal of Sustainability in Higher Education*, vol. 6, no. 4, pp. 383–391, Dec. 2005, doi: 10.1108/14676370510623865.
- [35] K. Andersson, "Starting the pluralistic tradition of teaching? effects of education for sustainable development (ESD) on pre-service teachers' views on teaching about sustainable development," *Environmental Education Research*, vol. 23, no. 3, pp. 436–449, Mar. 2017, doi: 10.1080/13504622.2016.1174982.
- [36] E. Fonsén and U. Soukainen, "Sustainable pedagogical leadership in Finnish early childhood education (ECE): an evaluation by ECE professionals," *Early Childhood Education Journal*, vol. 48, no. 2, pp. 213–222, Mar. 2020, doi: 10.1007/s10643-019-00984-y.
- [37] N. Esa, "Environmental knowledge, attitude and practices of student teachers," *International Research in Geographical and Environmental Education*, vol. 19, no. 1, pp. 39–50, Apr. 2010, doi: 10.1080/10382040903545534.
- [38] I. Ocetkiewicz, B. Tomaszewska, and A. Mróz, "Renewable energy in education for sustainable development. the Polish experience," *Renewable and Sustainable Energy Reviews*, vol. 80, pp. 92–97, Dec. 2017, doi: 10.1016/j.rser.2017.05.144.
- [39] D. K. Pamuk and R. Olgan, "Comparing predictors of teachers' education for sustainable development practices among eco and non-eco preschools," *Education and Science*, vol. 45, no. 203, pp. 327–345, Dec. 2019, doi: 10.15390/EB.2019.8774.
- [40] M. Perkasa, Agrippina, and Wiraningtyas, "Sustainable chemistry oriented on chemistry learning to increase student awareness to the environment," *Jurnal Sainsmat*, vol. 6, no. 2, pp. 63–72, 2017.
- [41] H. Kopnina, "Education for the future? Critical evaluation of education for sustainable development goals," *The Journal of Environmental Education*, vol. 51, no. 4, pp. 280–291, Jul. 2020, doi: 10.1080/00958964.2019.1710444.
- [42] J. O'Flaherty and M. Liddy, "The impact of development education and education for sustainable development interventions: a synthesis of the research," *Environmental Education Research*, vol. 24, no. 7, pp. 1031–1049, Jul. 2018, doi: 10.1080/13504622.2017.1392484.
- [43] K. Thiyagu and V. P. Joshith, "Perception towards the use of digital technology and factors generating technostress among teacher educators," *Review of International Geographical Education (RIGEO)*, vol. 11, no. 5, pp. 4182–4192, 2021, doi: 10.48047/rigeo.11.05.300.
- [44] J. Pauw, N. Gericke, D. Olsson, and T. Berglund, "The effectiveness of education for sustainable development," *Sustainability*, vol. 7, no. 11, pp. 15693–15717, Nov. 2015, doi: 10.3390/su71115693.
- [45] E. M. Waltner, K. Scharenberg, C. Hörsch, and W. Rieß, "What teachers think and know about education for sustainable development and how they implement it in class," *Sustainability*, vol. 12, no. 4, p. 1690, Feb. 2020, doi: 10.3390/su12041690.
- [46] R. K. Sharma, *National education policy 2020*. New Delhi: Goodwill Publications, 2023.
- [47] E. Carbach and D. Fischer, "Sustainability reporting at schools: challenges and benefits," *Journal of Teacher Education for Sustainability*, vol. 19, no. 1, pp. 69–81, Jun. 2017, doi: 10.1515/jtes-2017-0005.
- [48] M. Biasutti, T. de Baz, and H. Alshawa, "Assessing the infusion of sustainability principles into university curricula," *Journal of Teacher Education for Sustainability*, vol. 18, no. 2, pp. 21–40, Dec. 2016, doi: 10.1515/jtes-2016-0012.
- [49] S. Varghese, "Is the implementation of sustainable development at the heart of the National Education Policy 2020 vision?" *International Journal For Multidisciplinary Research*, vol. 5, no. 3, pp. 1–7, May 2023, doi: 10.36948/ijfmr.2023.v05i03.2883.
- [50] A. Sağdıç and E. Şahin, "A closer look into Turkish elementary teachers regarding their beliefs on education for sustainable development," *International Electronic Journal of Environmental Education*, vol. 6, no. 2, pp. 141–155, Jun. 2016, doi: 10.18497/iejee-green.42181.
- [51] M. Scoullou and V. Malotidi, *Handbook on methods used in environmental education and education for sustainable development*. Athens: MIO-ECSDE, 2004.
- [52] A. C.-C. Ko and J. C.-K. Lee, "Teachers' perceptions of teaching environmental issues within the science curriculum: a Hong Kong perspective," *Journal of Science Education and Technology*, vol. 12, no. 3, pp. 187–204, 2003, doi: 10.1023/A:1025094122118.
- [53] M. Green and M. Somerville, "Sustainability education: researching practice in primary schools," *Environmental Education Research*, vol. 21, no. 6, pp. 832–845, Aug. 2015, doi: 10.1080/13504622.2014.923382.
- [54] K. Andersson, S. Jagers, A. Lindskog, and J. Martinsson, "Learning for the future? Effects of education for sustainable development (ESD) on teacher education students," *Sustainability*, vol. 5, no. 12, pp. 5135–5152, Dec. 2013, doi: 10.3390/su5125135.
- [55] A. V. Agbedahin, "Sustainable development, education for sustainable development, and the 2030 agenda for sustainable development: emergence, efficacy, eminence, and future," *Sustainable Development*, vol. 27, no. 4, pp. 669–680, Jul. 2019, doi: 10.1002/sd.1931.
- [56] S.-S. Weng, Y. Liu, J. Dai, and Y.-C. Chuang, "A novel improvement strategy of competency for education for sustainable development (ESD) of university teachers based on data mining," *Sustainability*, vol. 12, no. 7, p. 2679, Mar. 2020, doi: 10.3390/su12072679.

BIOGRAPHIES OF AUTHORS

Sijo Varghese    is a research scholar who is pursuing a Ph.D. in Social Work at CHRIST (Deemed to be University) in Bangalore. He was a guest faculty member at the Bharata Mata School of Social Work in Thrikkakara, Kochi-682021, and Christ (Deemed to be University) in Bangalore, for a couple of years. The research scholar is enrolled at Christ (Deemed to be University) in Bangalore. He presented a few research papers at national and international conferences in South India. These research papers have been published in numerous Scopus, Web of Science, and non-Scopus publications. His research interests include the sustainable development goals (SDGs), sustainability, sustainable development, education for sustainable development, and secondary school teachers. He can be contacted at email: sijo.varghese@res.christuniversity.in.



P. M. Mathew    is an associate professor of Social Work at CHRIST (Deemed to be University), Bengaluru, India. He previously served at the Central University of Kerala and worked under the British government in London in the area of child protection. With expertise in child protection and family welfare, he has guided 15 MPhil scholars and 7 Ph.D. scholars. He has delivered training programs on child protection for social workers and government officials in countries such as Vietnam, Cambodia, and the Netherlands. He has presented 72 research papers at various national and international conferences and seminars worldwide. His work is widely published in Scopus, Web of Science, and UGC CARE-listed journals. He has actively collaborated with the Japan College of Social Work and the Association for International Social Work (AISW), Japan, contributing to joint research presentations, publications, and international conferences. Currently, he is coordinating an international conference on Family and Child Protection in collaboration with Katho University, Germany, which will culminate in the publication of an edited volume. He can be contacted at email: mathew.pm@christuniversity.in.