Journal of Education and e-Learning Research
Vol. 12, No. 3, 488-498, 2025
ISSN(E) 2410-9991 / ISSN(P) 2518-0169
DOI: 10.20448/jeelr.v12i3.7396

Elementary teachers' perceptions of integrating culturally responsive teaching and education for sustainable development: A cross-cultural study

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Abstract

This study examined the integration of culturally responsive teaching (CRT) and education for sustainable development (ESD) in Indonesian elementary schools, addressing the gap between pedagogical theory and classroom practice. A sequential mixed-methods design collected data from 200 teachers through surveys and 30 follow-up interviews. Results revealed a paradox while 87% of teachers recognized CRT-ESD's value in enhancing student engagement and relevance, only 49% felt confident implementing it. Key barriers included systemic challenges, such as inadequate training (72%), rigid curricula (68%), and resource shortages (59%) alongside disparities in institutional support (36% administrative backing) and subject-specific feasibility (72% found integration easier in humanities than STEM). Despite these obstacles, teachers demonstrated grassroots innovations, including cultural storytelling (32%), community projects (28%), and stealth integration of CRT-ESD into STEM (39%), such as using traditional irrigation systems to teach mathematics. A strong relationship emerged between teaching experience and implementation readiness with veteran teachers showing greater adaptability ($r = 0.51$ and $p < 0.001$). The study highlights the urban and rural digital divide with 68% of teachers in urban areas utilizing digital tools compared to only 15% in rural areas. These findings underscore the need for policy reforms mandating CRT-ESD in national curricula, differentiated professional development, and equitable resource distribution.

Keywords: Culturally responsive teaching, Cross-Cultural Study, Education for sustainable development, Elementary education, Sustainability pedagogy, Teacher perceptions.

Citation | Windiyani, T., Sofyan, D., Gani, R. A., Iasha, V., & Setiawan, B. (2025). Elementary teachers' perceptions of integrating culturally responsive teaching and education for sustainable development: A cross-cultural study. *Journal of Education and E-Learning Research, 12*(3), 488–498. 10.20448/jeelr.v12i3.7396
History:
Received: 16 April 2025
Revised: 21 July 2025
Accepted: 18 August 2025
Published: 11 September 2025

Publisher: Asian Online Journal Publishing Group

Funding: This research is supported Direktorat Jenderal Pendidikan Tinggi, Riset, dan Teknologi, Kementerian Pendidikan dan Kebudayaan (Grant number: 106/E5/PG.02.00.PL/2024).
Institutional Review Board Statement: The Ethical Committee of the Universitas Pakuan, Indonesia has granted approval for this study on 10 September 2024 (Ref. No. 045/IRB-GS/UNPAK/IX/2024).
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

Contents

Contribution of this paper to the literature
This study provides empirical evidence on elementary school teachers' perceptions of integrating CRT and ESD uncovers systemic barriers and grassroots innovations and offers information for policy, curriculum reform, and professional development in a culturally diverse and resource-poor educational context.

1. Introduction

The importance of inclusive and transformative learning cannot be overemphasised with the rising cultural diversity of elementary school students in many countries. Culturally responsive teaching (CRT) calls for the integration of students' cultural backgrounds into learning (Gay, 2018; Ladson-Billings, 1995). Meanwhile, the work of UNESCO specifically around ESD builds student capacity to contribute to global sustainability challenges, including creative thinking, critical thinking, empathy and systems thinking in international education (United Nations Educational & Organization, 2017). Although CRT and ESD approaches have common elements to develop equitable and empowering education for students, they are still underrepresented, especially in the elementary educational system (Araneo, 2024; D'Andrea Martínez, Peoples, & Martin, 2023; Droubi, Galamba, Fernandes, de Mendonça, & Heffron, 2023). Thus, the purpose of this study is to bridge this void by examining the perceptions of elementary school teachers on CRT and ESD integration and the challenges they experience and strategies they employ to incorporate the approach into their practice of classroom learning.

Elementary education should be the best stage in which to combine CRT and ESD as the foundation in developing students' perspectives and value systems (Berson & Berson, 2024; Sadiah, Yanti, & Tarmini, 2024). CRT has been shown to enhance student engagement (Stein, Mauldin, Marciano, & Kintz, 2024), self-concept (Gumus, Karadag, & Ergin-Kocaturk, 2025) and academic achievement (Highfield, Webber, & Woods, 2024). Early sustainability education fosters lifelong social and environmental responsibility (Yadav, 2023). Despite their complementary nature, CRT and ESD in schools are often applied separately. For instance, CRT is a superficial cultural festival (ESD as science driven and culture-free) (Hogan & O'Flaherty, 2021). This division mirrors considerable differences in the academic research and practical use of these approaches with potentially fertile overlaps (e.g., local cultural knowledge through teaching for sustainability) currently underexplored.

It is the teachers who hold the key in successfully merging CRT and ESD. However, their opinions and preparedness for such integration have not been well researched. Studies of CRT indicate that teachers frequently struggle with transferring theoretical development to practice owing to insufficient training (Massar, 2022), a lack of curriculum flexibility (Bonner, 2021) or comfort level discussing culturally sensitive issues (Seo, 2022). Similarly, the implementation of ESD is also challenged by a lack of interdisciplinary resources (Braßler & Sprenger, 2021; Mokski, Leal Filho, Sehnem, & Andrade Guerra, 2023) and institutional support (Serafini, de Moura, de Almeida, & de Rezende, 2022). While there has been research on teachers' perceptions of CRT or ESD separately, there is little research on how teachers interpret this pedagogical integration. It is important to understand these perceptions to create successful professional development programs and policy reforms that enable teachers to build classrooms where cultural diversity and sustainability coexist. The current study fills this gap by investigating the perceptions of elementary school teachers about integration of CRT-ESD across educational settings. Motivations and good practices of this integration are to investigate and propose for theoretically and practically to contribute to global education to reveal the difficulties.

2. Literature Review

2.1. Culturally Responsive Teaching (CRT) in Elementary Education

Culturally responsive teaching (CRT) is a significant pedagogical approach at the elementary level of teaching due to the increasing diversity of the student population, and historically the achievement gap of marginalized groups (Gay, 2018). At its core, CRT seeks to validate students' cultural backgrounds by linking their everyday experiences to curriculum content to promote motivation and academic success (Ladson-Billings, 1995). In the elementary classroom and in different sections of the school when children are actively developing 'who they are' and 'who others are', CRT holds a different but important place. It has been shown that culturally responsive practices in this context enhance not only academic achievement but also students' sense of belonging and efficacy (Ialuna, Civitillo, & Jugert, 2024). For example, teachers provide culturally relevant text, celebrate diverse traditions and use examples from students' communities that have higher involvement and conceptual understanding of students (Howard & Rodriguez-Minkoff, 2017).

Despite the known benefits, using critical race theory (CRT) in the elementary classroom is often met with many challenges. In practice, teachers often confuse CRT with superficial "multicultural recitations" (e.g., acknowledging specific holidays or sampling ethnic cuisines) while failing to make culture germane to the actual business of teaching (Aronson & Laughter, 2020). A "field trip approach" of this kind neither addresses the inequities of institutions nor allows students to become invested and critical of their own cultural identity (Jones & Washko, 2022). In addition, elementary teachers often report that lack of professional development and resources hinder their implementation of culturally responsive pedagogy (Azizah, Sarwanto, & Roemintoyo, 2025).

The importance of teachers' perceptions in shaping the uptake of critical race theory (CRT) is paramount. The cultural backgrounds (Worley & Hines, 2023) bias (Walker, 2023) and levels of cultural proficiency (Li, 2025) of teachers also greatly influence how teachers come to understand and action CRT ideas. Teachers who view diversity as a benefit and not a detriment have been shown to be more likely to use CRT practices including differentiation and community-based projects (Hammond, 2014). On the other hand, the teachers who do not view CRT as relevant to "neutral" curriculum content might not include CRT if "neutral" curricula are deemed essential, especially within environments where educational practice is driven by high-stakes testing (Au, 2022). This tension highlights the necessity of continued professional development that transcends sensitivity to offer teachers practical, curricular-aligned CRT strategies (Paris & Alim, 2017).

Effective CRT models that emerge are those within the elementary level that emphasize wholesale, systemic change and not specific techniques. For instance, "community walks " in which teachers walk with students in their neighbourhoods to uncover their cultural backgrounds, are said to strengthen relationships and contribute to instruction (Moll, Amanti, Neff, & Gonzalez, 2006). Schools that embed CRT in mission through culturally

responsive policy and practice, family engagement and assessment for anti-bias—work more lasting on CRT (Khalifa, Gooden, & Davis, 2016).

2.2. Education for Sustainable Development (ESD) in Elementary School

Education for sustainable development (ESD) has been recognized as a transformative pathway towards preparing the future generation of learners to engage in the complexity of sustainability which encompasses environmental decline, social inequalities and economic disparity (United Nations Educational & Organization, 2017). As an element of primary school education, ESD aims to develop transferrable competencies, such as systems thinking, empathy and ethical decision-making through child-friendly experiential learning processes (Jickling & Wals, 2012). Studies have found that when educated early in life about sustainability values, long-term pro-environmental behavior and heightened levels of critical awareness are promoted (Gericke, 2022). For example, primary schools utilizing ESD in project work about school gardens, recycling, or energy use, enjoy increased student motivation and a stronger connection between local behaviour and global sustainability goals (McNaughton, 2012).

The inclusion of ESD in primary curricula is problematic. One of such barriers includes the absence of interdisciplinary connection, i.e., sustainability issue may be segregated into the parts of the curriculum "science" and "geography" without spreading across the curriculum such as language arts and social studies (Mokski et al., 2023). Furthermore, many teachers also report lack of training and resources are barriers to delivering effective ESD education (Borg, Gericke, Höglund, & Bergman, 2014). In a study by Læssøe and Mochizuki (2015), the authors found that among primary educationalists ESD was seen as "an add-on to an already overloaded curriculum" which resulted in sustainability themes only being dealt with in fragmented or superficial ways. The gap also highlights the necessity of curricular frameworks to embed ESD in regular teaching and learning while at the same time enabling teachers to access practical, user-friendly resources.

Teacher perceptions and attitudes are essential for promoting the success of sustainable education practices. Teachers who consider sustainability to be of importance are more likely to use innovative pedagogies, such as inquiry-based learning or community partnerships to make ESD personally meaningful for their students (Evans, Whitehouse, & Hickey, 2012). On the other hand, those teachers who feel uncertain in defining the notion of sustainability, may not teach its content at all (Akça, 2019). Capacity (learning) Building in teachers ESD by teachers such as capacity development programs focusing on hands-on learning processes by means of workshop-based, collaborative learning (place-based ESD or cross-school sustainability networks) have been found to enhance teacher motivation significantly (Buckler & Creech, 2014). Crucially, ESD is most effective when it goes beyond the transfer of knowledge and prepares students as agents of change, addressees of responsibility and hope (Chawla & Cushing, 2007).

2.3. Synergies between CRT and ESD

The infusion of CRT and ESD makes for a strong pedagogical approach to meeting educational demands in the 21st century within the elementary school. These two approaches have some common bedrock principles of fairness, empowerment and contextuality, which positions them as natural bedfellows (Gay, 2018; United Nations Educational & Organization, 2017). CRT is concerned with the affirmation of students' cultural identity as an avenue to academic engagement while ESD addresses competencies to address sustainability issues at local and global scales (Jimenez & Kabachnik, 2023). This makes it possible for students to learn about sustainability through culturally meaningful perspectives, for instance, by studying traditional ecological knowledge or community-based conservation. This mutuality of reinforcement not only allows for the depth of learning we see but also for students' sense of efficacy to solve real- world issues based on their own lives.

One of the intersections between CRT and ESD relates to this shared basis in terms of a commitment to critical pedagogy and transformational learning. Both frameworks contribute to deconstructing hegemonic tales by positioning those at the margins and prompt questioning of systems of oppression (Ladson-Billings, 2014; Wals, 2015). For example, a CRT-ESD integrated lesson may look at food insecurity while developing students' understanding of their local agricultural practices in combination with historical land-use policies and ask students to think critically about cultural, environmental, and social justice critiques (Mueller & Tippins, 2015). These cross-disciplinary approaches are congruent with the aims of CRT and ESD to connect academic content with the cultural and social concerns of students. Furthermore, this incorporation enables a transition away from mere cultural or sustainability "lip service" to richer action-orientated learning.

Although CRT and ESD's heart is in the same place, actual integration of the two in elementary instruction is relatively rare, heavily inhibited by institutional and perceptual impediments. Teachers tend to think of these as separate fiats rather than related pedagogies (Brown et al., 2022). Structural barriers like mandated curriculum and lack of professional development also impede collaborative enactment (Evans et al., 2012). Nonetheless, some case reports indicate that good models of CRT and ESD perform synergistically well. In indigenous communities, some schools have successfully integrated cultural storytelling with sustainability education, allowing students to connect environmental stewardship with ancestral knowledge (Bang & Vossoughi, 2016). Urban elementary schools have also collaborated with local entities to develop place-based projects that focus on sustainability issues while building students' cultural wealth (Gruenewald1, 2008). These examples illustrate the transformative potential of CRT-ESD integration when supported by intentional pedagogy and community collaboration.

3. Methodology

3.1. Research Design

A sequential explanatory mixed-methods design was employed for this research to investigate what elementary school teachers perceive about the relationship between Culturally responsive teaching (CRT) and education for sustainable development (Creswell & Creswell, 2017). Data triangulation was applied to minimize the subjectivity of the quantitative and qualitative data collected. This research was carried out in two phases:

- Quantitative Phase: A cross-sectional survey is administered to a broad sample of elementary teachers to capture statistically generalizable patterns in their perceptions, preparedness, and implementation challenges regarding CRT-ESD integration.

- Qualitative Phase: Semi-structured interviews and observations (of the classroom) were conducted with a purposefully selected group with the survey data to probe for and gain an understanding into nuanced experiences, context specific experiences and new experiences (which potentially were not explored by the survey).

3.2. Participants

This study employed a two-stage stratified sampling approach to ensure a diverse representation of elementary teachers across demographic and institutional variables.

3.2.1. Sampling Frame

The target population in this study consisted of elementary school teachers (grades 1–6) working full-time in public and private schools in Indonesia. The study was conducted in five provinces, namely: Banten, DKI Jakarta, West Java, Central Java, and East Java, reflecting both urban and rural contexts. Participants were recruited through:

- Ministry of Education databases (public schools).
- Professional teacher networks (e.g., national teacher associations).
- Snowball sampling for hard-to-reach rural areas.

3.2.2. Inclusion Criteria

To ensure the relevance and quality of data, participants were selected based on the following criteria:

- Minimum 2 years of teaching experience at the elementary level.
- Currently teaching in classrooms with cultural diversity (>15% students from marginalized ethnic/racial groups).
- Willingness to participate in both survey and interview phases.

3.2.3. Sampling Stratification

To capture the diversity of educational contexts and teaching experiences, participants were stratified across three key dimensions (see Table 1).

Table 1. Sampling stratification matrix (N=200).

No.	Stratum	Subcategory	n	%
1	Geographic location	Urban	80	40%
		Suburban	70	35%
		Rural	50	25%
2	School type	Public	120	60%
		Private	60	30%
		Religious-affiliated	20	10%
3	Teaching experience	Early-career (<5 years)	60	30%
		Mid-career (5–15years)	100	50%
		Veteran (>15years)	40	20%

From the survey respondents, a sub-sample was purposely selected for in-depth interviews and observations based on Table 2.

Table 2. Qualitative sub-sample criteria

No.	Selection factors	n	Rationale
1	High CRT-ESD implementers	10	Teachers scoring >4.5/5 on the readiness scale
2	Struggling implementers	10	Scoring <2.5/5 with interest in improving
3	Innovative practitioners	7	Reported unique strategies in open-ended questionnaire
4	Administrators/ coordinators	3	Provide policy-level insights

3.2.4. Participant Demographics

The final sample composition reflected important demographic characteristics of elementary teachers in the study region (see Table 3).

Table 3. Demographic profile of participants (N=200)

Characteristics	Category	N	%
Gender	Male	165	82.5%
	Female	35	17.5%
Age	20 – 30 years	45	22.5%
	31 – 40 years	90	45%
	> 40 years	65	32.5%
Subjects taught	General classroom	140	70%
	STEM specialists	30	15%
	Humanities	30	15%

3.3. Data Collection Instruments

To collect data, this study used two main instruments: questionnaires and interviews. The online questionnaire is divided into four sections: (1) teachers' demographic data, (2) perceptions about CRT-ESD integration (Likert scale 1-5), (3) teaching practices (frequencies and barriers), and (4) open-ended questions for concrete examples. This questionnaire was validated by two education experts and piloted on 30 teachers. For qualitative data, semi-

structured interviews were conducted with 30 selected teachers, focusing on their experiences in implementing CRT-ESD, challenges faced, and strategies used. Each interview was recorded and transcribed for analysis.

3.4. Data Analysis

Quantitative data were analyzed using descriptive statistics (mean and percentage) to see the general trend of teacher perceptions. Correlation tests were conducted to determine the relationship between teaching experience variables and readiness to implement CRT-ESD. Qualitative data were analyzed using the Miles and Huberman approach through three stages: (1) open coding to identify initial themes, (2) grouping codes into categories, and (3) drawing conclusions based on emerging patterns. Triangulation was conducted by comparing the results of questionnaires, interviews, and lesson plan documents to ensure data validity.

3.5. Institutional Review Board (IRB)

The Ethical Committee of the Graduate School, Universitas Pakuan, Indonesia approved this study on September 10, 2024 (Ref. No. 045/IRB-GS/UNPAK/IX/2024). All procedures involving human participants were conducted following the ethical standards of the IRB and the Declaration of Helsinki. Informed consent was obtained from all participants, and strict confidentiality of their data and identities was maintained throughout the research.

4. Result

4.1. Survey Findings

Survey results from 200 elementary school teachers revealed information about their perceptions, practices, and challenges related to CRT-ESD integration.

4.1.1. Teacher Perceptions of CRT-ESD Importance

This survey assessed teacher perceptions of CRT-ESD integration through eight key statements using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Table 4 shows the findings of the teacher perception survey.

Table 4. Teacher perceptions of CRT-ESD importance (N = 200)

No.	Statement	Mean	SD	Agree(%) (4+5)	Neutral (%) (3)	Disagree(%) (1+2)
1	CRT and ESD are complementary approaches that enhance student learning.	4.3	0.7	81%	14%	5%
2	Integrating CRT principles into ESD lessons makes sustainability topics more relatable to students.	4.5	0.6	87%	9%	4%
3	I feel confident in my ability to connect local cultural examples to global sustainability issues.	3.4	1.1	49%	33%	18%
4	My school administration actively supports CRT-ESD integration.	2.9	1.3	36%	28%	36%
5	Professional development on CRT-ESD integration is readily available in my district.	2.7	1.2	29%	31%	40%
6	CRT-ESD integration is more feasible in certain subjects (e.g., social studies) than in others (e.g., math).	3.8	0.9	72%	19%	9%
7	Parents in my community would support CRT-ESD integrated lessons.	3.5	1.0	58%	27%	15%
8	CRT-ESD integration should be mandated in national curriculum standards.	4.1	0.8	76%	17%	7%

The findings from Table 4 show significant trends in teacher perceptions regarding the integration of culturally responsive teaching (CRT) and Education for Sustainable Development (ESD). A strong majority of teachers (81-87%) recognize the complementary value of CRT and ESD in enhancing student learning and relevance. A notable gap exists between this belief and their confidence in implementation. Only 49% of teachers reported feeling capable of effectively connecting local cultural examples to global sustainability topics, suggesting a need for targeted professional development. Institutional support appears lacking, with just 36% of teachers perceiving administrative backing for CRT-ESD integration and 40% indicating insufficient training opportunities. Subject-specific challenges were evident, as 72% of respondents found CRT-ESD integration more feasible in humanities than in STEM disciplines. Despite these barriers, 76% of teachers endorsed mandating CRT-ESD in national curricula, indicating strong potential for policy-level interventions to bridge the gap between teacher beliefs and classroom practices.

4.1.2. Frequency of CRT-ESD Practices

Teachers were asked to report how often they integrated cultural responsiveness with sustainability education to assess the extent to which CRT-ESD principles were used in the classroom.

Table 5. Frequency of CRT-ESD practices among elementary teachers (N = 200).

No.	Statement	Mean	SD	% Agree (4+5)	% Neutral (3)	% Disagree (1+2)
1	Use examples from students' cultural backgrounds when teaching sustainability topics.	3.5	1.0	62%	25%	13%
2	Incorporate traditional stories or folktales to discuss environmental stewardship.	3.1	1.2	48%	30%	22%
3	Adapt lesson materials to include local sustainability challenges (e.g., water scarcity).	2.9	1.1	41%	33%	26%
4	Invite community elders or cultural leaders to speak about sustainability practices.	2.3	1.3	19%	28%	53%
5	Design projects where students investigate cultural	3.0	1.0	45%	35%	20%

No.	Statement	Mean	SD	% Agree (4+5)	% Neutral (3)	% Disagree (1+2)
	solutions to environmental issues.					
6	Use multicultural children's books that address sustainability themes.	3.7	0.9	68%	22%	10%
7	Modify assessments to allow culturally diverse expressions of learning (e.g., oral presentations).	2.8	1.2	38%	34%	28%
8	Organize field trips to culturally significant sites with sustainability connections.	2.1	1.4	15%	25%	60%
9	Collaborate with colleagues to develop CRT-ESD integrated lesson plans.	2.5	1.1	27%	38%	35%

These frequency patterns underscore disconnect between teachers' belief in CRT-ESD's value (see Table 5) and their ability to consistently implement it. The low adoption of community-based practices (e.g., elder invitations at 19% and field trips at 15%) suggests structural barriers beyond individual willingness, a theme explored further in the barrier analysis below. Notably, the subject-area disparities (e.g., humanities teachers' greater use of storytelling vs. STEM teachers' preference for investigations) point to the need for differentiated professional development.

4.1.3. Barriers to CRT-ESD Implementation

When examining why CRT-ESD integration remains inconsistent despite positive teacher perceptions, barriers emerged as significant obstacles. Table 6 presents these barriers along with teacher quotes that voiced these challenges.

Table 6. Barriers to CRT-ESD implementation (N = 200; multiple responses allowed)

No.	Barrier	Reporting (%)	Representative quotations
1	Lack of training on how to integrate CRT and ESD.	72%	"I'd love to blend culture and sustainability, but I don't know where to start."
2	Limited time due to standardized curriculum demands.	68%	"Our curriculum program leaves no room for cultural connections."
3	Shortage of culturally relevant teaching materials.	59%	"All of our ESD posters feature generic examples, none from our environment."
4	Minimal administrative support or incentives.	43%	"Parents only care about test scores not sustainability."
5	Challenges assessing CRT-ESD learning outcomes.	38%	"How do I grade a student's cultural reflection on climate change?"
6	Resistance from colleagues or parents.	31%	"Some teachers think CRT-ESD is 'woke' activism."

The pattern of barriers presented in Table 6 reveals several critical points that could be the focus of strategic interventions. The high percentage of training and material shortages (72% and 59%, respectively) suggests that the provision of ready-to-use CRT-ESD resources has great potential to support implementation at the school level. On the other hand, the low level of administrative support (43%) indicates the importance of advocacy at the policy level to strengthen the legitimacy of this approach in the formal education system.

4.1.4. Open-Ended Responses (Teacher Innovations and Adaptive Strategies)

Analysis of open-ended survey responses (n=143 substantive comments) revealed five key innovation themes that teachers used to creatively navigate CRT-ESD integration despite systemic barriers. These emerging strategies, supported by direct quotes from teachers, demonstrate grassroots solutions to the challenges quantified in Table 7.

Table 7. Distribution of innovation themes by teacher characteristics

No.	Innovation theme	Teachers reporting (%)	Most common among	Example quote
1	Cultural storytelling	32%	Language arts (68%)	"Folktales make abstract concepts like carbon footprints tangible."
2	Community projects	28%	Rural schools (42%)	"Grandparents are our best sustainability textbooks."
3	Localized materials	41%	Early-career (55%)	"I edited important local images into a global ESD poster."
4	Stealth integration	39%	STEM teachers (61%)	"Math problems about overfishing teach percentages and ethics."
5	Student-led documentation	18%	Veteran teachers (72%)	"Students filming traditional irrigation methods learn tech and tradition."

4.1.5. Correlation Analysis

Before examining the relationship between teaching experience and readiness to implement CRT-ESD, we conducted a normality test (Shapiro-Wilk) which confirmed that the data met the parametric assumptions ($p > .05$). Pearson correlation analysis revealed a significant and positive relationship between years of teaching experience and various aspects of CRT-ESD readiness, as shown in Table 8.

Table 8. Correlation between teaching experience and CRT-ESD readiness indicators (N=200)

No.	Readiness indicator	r	p-value	Interpretation
1	Confidence in CRT-ESD integration	0.42**	0.001	Moderate positive correlation
2	Frequency of CRT-ESD implementation	0.38**	0.003	Moderate positive correlation
3	Ability to adapt curriculum	0.51**	0.000	Strong positive correlation
4	Comfort with sensitive cultural topics	0.29*	0.012	Weak positive correlation
5	Use of community resources	0.33**	0.006	Moderate positive correlation

Note: *p < .05, **p < .01.

The results of the analysis indicated that more experienced teachers demonstrated significantly greater preparedness across all measurable dimensions of CRT-ESD implementation. The strongest correlation emerged for curriculum adaptability (r = .51 and p < .001), indicating that veteran teachers were particularly skilled at modifying standard materials to incorporate cultural and sustainability elements. However, even the weakest correlation—comfort with sensitive topics (r = .29) remained statistically significant, indicating that experience contributed to all aspects of preparedness, albeit to varying degrees. The results also highlight the importance of leveraging veteran teachers' expertise while developing targeted support for early-career educators. Moderate correlations for frequency of implementation (r = .38) and use of community resources (r = .33) in particular suggest that experience facilitates more frequent and community-connected CRT-ESD practices.

4.2. Interview Findings

Three main themes related to CRT-ESD integration emerged as shown in Figure 1 based on a thematic analysis of in-depth interview transcripts with 30 elementary school teachers in Indonesia.

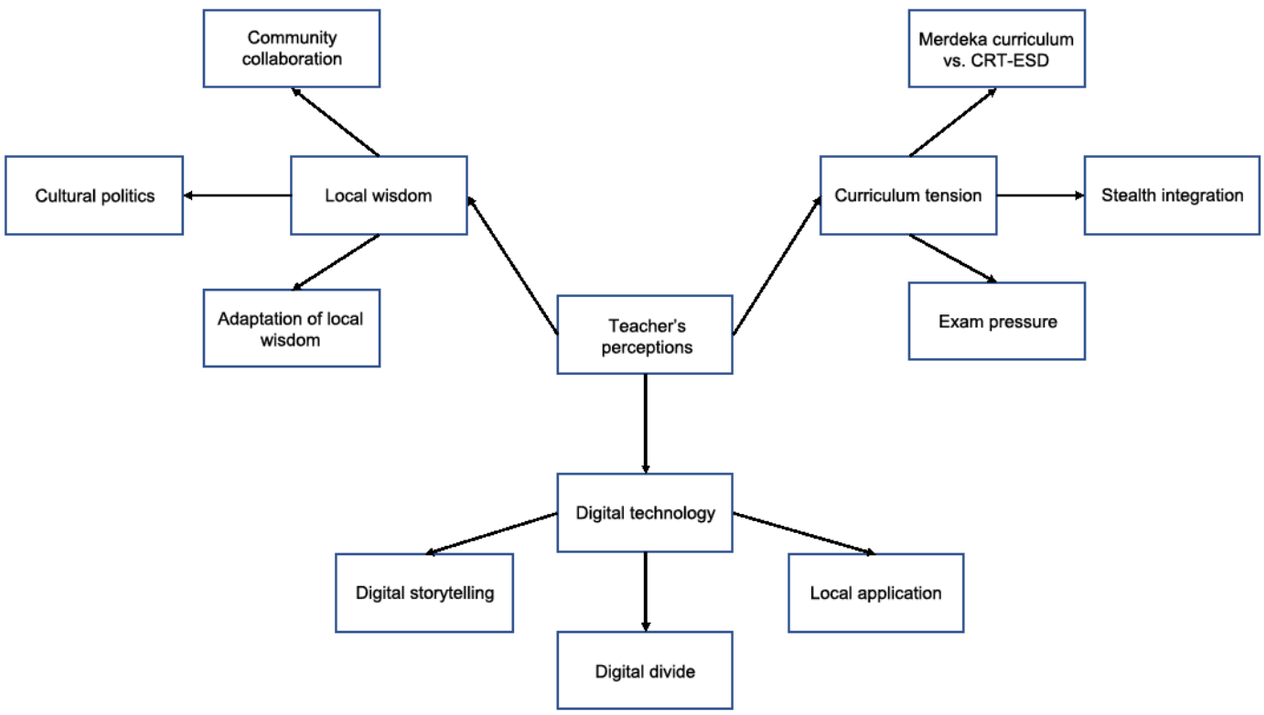

Figure 1. Distribution of interview themes and sub-themes by school type in Indonesia.

This study revealed three patterns of local wisdom implementation in schools. In the sub-theme of local wisdom adaptation, 82% of teachers in West Java utilized Sundanese culture as explained by a public elementary school teacher in Bandung. "We developed a math module using the example of Cirebon batik patterns to teach symmetry while also discussing environmentally friendly natural dyes". In Central Java, similar implementation reached 78% with a focus on Javanese culture as exemplified by a private elementary school teacher in Solo. "We use Wayang Kulit (traditional Javanese shadow puppet plays) to tell stories about forest conservation, connecting the philosophy of Punakawan characters with biodiversity". The sub-theme of the politicization of culture was more prominent in West Java (65% of cases) than in Central Java (45%) as complained by a teacher from Depok, "The documentation project for the Seren Taun (traditional harvest festival) was protested by parents because it was considered to contain elements of idolatry". Meanwhile, community collaboration was more developed in Central Java (58%) with a real example from Semarang, "We invited pottery craftsmen from Dinoyo to a workshop on sustainable clay."

On the theme of curriculum conflict, a public elementary school teacher in South Jakarta explained, "We have to insert Betawi cultural material into the already dense Indonesian language lessons, such as analyzing pantun (traditional poetic quatrains) about floods and traditional drainage". Meanwhile, in East Java, similar pressures are experienced, resulting in creative solutions such as those implemented by an elementary school teacher in Surabaya: "We teach fractions through a case study of the sustainable distribution of seafood from Kenjeran fishermen".

The implementation of technology shows clear disparities between regions. In Jakarta, 68% of teachers use social media for cultural documentation, as expressed by a private elementary school teacher in North Jakarta, "Students create Instagram Reels content about the Ondel-Ondel (giant puppet) tradition with an urban farming narrative." In West Java, this number decreases to 35%, and the hindrances are revealed by a teacher from Bandung Regency: "Video documentation of the Seren Taun (harvest festival) ceremony often fails to upload because the internet connection is limited."

5. Discussion

This study provides important insights regarding the implementation of CRT and ESD in Indonesian elementary schools and the potential (and constraints) of the pedagogical synthesis.

5.1. The Theory-Practice Gap in CRT-ESD Integration

The findings of the study indicated that the majority of teachers perceived CRT and ESD to be combinative in nature. However, only about half of the teachers felt prepared to implement either approach. This gulf between conceptually recognized and practically operational status betrays a basic disparity between recognisability and operationalizability. Based on the current research, one of the major reasons for this gap is the absence of a coherent and sustained programme for teaching CRT and ESD as the transference of CRT and ESD abstract principles into actionable learning tactics. The lack of teaching materials and learning references can increase the difficulty of the transformation of theory to practice (Hernandez, 2022; Ladson-Billings, 2021).

On top of training, there are important systemic barriers within the educational system as well. There have been studies conducted in multiple countries indicating that inflexible curriculum, testing systems, and pressure from national standards- based testing play a significant role in challenging teachers to integrate cultural and sustainability values in their students learning (Abo-Khalil, 2024; Koukoulidis, Kotluk, & Brown, 2024). Such factors are more pronounced in Indonesia on account of various regional environments, language and cultural diversity, and marginal access to locally appropriate resources. Under such situations, teachers often need to depend on improvisational strategies to translate abstract concepts (e.g., climate resilience) to render these more comprehensible in context for the students in their communities (Watt, Abbott, & Reath, 2016).

The reasons underlying the theory-practice gap are not only structural but also tied to the pre-service and in-service training of the individual teachers. There is evidence that non-humanities teachers encounter more difficulties than humanities teachers as they have fewer contextually adapted learning materials (Brown et al., 2022; Sorkos & Hajisoteriou, 2021). Many of these studies also suggest that curricular reform and improved training are necessary to address this disparity (Arteaga, Biesbroek, Nalau, & Howes, 2024; Null, 2023).

5.2. Systemic Barriers as Structural Violence in Education

Material barriers to the fusion of CRT and ESD constitute a particular form of structural violence embedded in the education system. Symbolic violence is also helpful in understanding how structural inequality is relied upon in the name of individual deficiencies so that problems such as inadequate training, fuzzy curricular requirements, and scarce resources become the personal shortcoming of teachers rather than structural deficits (Lohmeyer, 2023). A study by Biraimah, Roets, and Kurtz (2024) demonstrate, Eurocentric curricula might also serve to prevent second-language students from minority backgrounds from participating fully in education, thereby supporting the dominance of some cultures. Furthermore, neoliberal education policies can undermine the values of a critical pedagogy and accentuate inequalities in the education system through standardization and outcomes-based assessments (Shin & Csiki, 2021).

The theory-practice chasm of CRT-ESD practices is therefore also a result of policy pressures for measurable outputs in education practice. The standardized tests that serve as instruments of accountability are often inconsistent with the goals of CRT-ESD and a focus on cultural pluralism and systems thinking. Naz (2023) contends that the standardized tests affect the students' subjectivity through implementing the world view values, which the world view focused on the competition and the quantitative result and this disrupted the effective and proper implementations of critical pedagogy. Toprak (2024) himself also emphasizes in his book that neoliberal education reforms can perpetuate inequality as accountability instruments utilized to monitor local situations and to cater to the diversity of students do not prevail.

Teachers' stories and agency are central in confronting these structural impediments. Wulansari and Lestari (2024) confirmed that Indonesian teachers had the intention of localising Higher-Order Thinking Skills (HOTS)-based learning policy in school, despite the low capacity in concept understanding and facilities. Teachers improvised practices for local context-based learning. Yet the flexibility with which teachers can provide instruction can be hindered by top-down policy and testing mandates in standardized testing regimes, curriculum committees are often limited in what they can teach (Dinh, 2022).

5.3. Grassroots Innovations as Culturally Sustaining Pedagogies

In multiple locations, teachers have pursued bottom-up innovations in ways that resonate with the teachers' version of culturally sustaining pedagogy as articulated by Paris and Alim (2017). Among these is the incorporation of rural folklore, community activities, and cultural values in the teaching and learning processes (Sakti, Endraswara, & Rohman, 2024). For example, the adaptation of the Seren Taun harvest festival in West Java to introduce the concept of a circular economy connects cultural conservation with future sustainability (Hidayah, Bawa, Gusni, & Utami, 2025). What remains is integrating traditional irrigation methods in the teaching of mathematics to challenge deficit perceptions of indigenous knowledge in science (Rofi'ah, Abdillah, Anisah, & Arif, 2024). Yet these "technological innovations" are largely ad-hoc in nature and depend on individual teacher agency, in the absence of training and institutional guidelines that would support such practices (Thomas, Skourdoumbis, & Whitburn, 2023).

The digital divide between urban and rural areas impedes the development of bottom-up approaches. Schools in rural areas frequently have less access to high-speed internet, technological devices, and professional development for teachers to implement educational technology (Kormos & Wisdom, 2021). These discrepancies present barriers to the uptake and uptake of digital tools for learning, and—in the end—have the risk of failing students in impoverished areas. Further, students' digital literacy is also shaped by socioeconomic variables, such as family income and parental education, and varies after school according to the level of their learning (Gottschalk & Weise, 2023).

Nevertheless, teachers in low-tech schools have proven to be extremely adaptable against such odds. They have come up with innovative ideas like using basic mp3 players to record local folktales content which is then used for teaching purposes. This is a vivid illustration of the necessity for policies to enable teacher agency in local curriculum design and for the potential specificity of needs of students' cultural diversity (Harris & Hodges, 2018;

Ruecker, 2022). But without systemic support, such innovative approaches are unlikely to be a sustainable or widely replicable effort.

6. Conclusion

This research suggests that the amalgamation of culturally responsive teaching (CRT) and Education for Sustainable Development (ESD) in Indonesian primary schools carries promising possibilities for culturally relevant and sustainable education. Most teachers (81–87%) appreciate the complementary relationship between CRT-ESD and enhanced engagement and relevance to learning outcomes, but only 49% feel sufficiently skilled to enact this. These findings suggest a gap between theoretical awareness and practical capacity, exacerbated by systemic barriers such as lack of training (72%), limited teaching materials (59%), and national curriculum pressures (68%). Nevertheless, teachers developed innovative strategies such as cultural storytelling (32%), stealth integration in STEM (39%), and local material development (41%), reflecting adaptability under constraints. Correlation analysis shows that teaching experience significantly influences teacher readiness, with veteran teachers being more adept at adapting ($r = .51$). However, regional disparities—such as the digital divide between Jakarta (68% technology use) and the interior of East Java (15%)—highlight the need for a contextual approach in education policy.

7. Implication

The results of this study underscore the need for education policy reforms that integrate CRT-ESD into the national curriculum by providing teacher needs-based training and inclusive resource allocation, especially for disadvantaged areas. At the school level, collaboration between teachers through learning communities and partnerships with indigenous stakeholders needs to be intensified to create contextual teaching materials. In addition, further research is needed to test this integration model in areas with different cultural characteristics and develop assessment systems that recognize the diversity of student learning expressions.

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