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Between vision and barriers: a qualitative study on school leadership and ESD implementation in Germany

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This study explores how school leaders in Baden-Württemberg, Germany, perceive and enact their role in the implementation of Education for Sustainable Development (ESD) within the framework of the Whole School Approach (WSA). Using a qualitative research design, we conducted semi-structured interviews with eleven school leaders from various school types. Thematic analysis identified five core dimensions shaping ESD implementation—vision, leadership, curriculum, resources, and communication—derived from the WSA and strongly reflected in participants' narratives. In addition, an inductively identified cross-cutting theme—leaders' understanding of ESD—emerged as central to how they engaged with all other dimensions. A notable contribution of this study is its nuanced documentation of leadership as a balancing act between aspiration, delegation, and constraint navigation. While school leaders expressed openness to sustainability, their engagement was often fragmented and environmentally focused. The study highlights the gap between policy ambition and school-level practice and underscores the need for leadership development, institutional support, and structural flexibility to realize the holistic aims of the WSA.

KEYWORDS

education for sustainable development, qualitative research, school development, school leadership, whole institution approach

1 Introduction

The pressing social, economic, and environmental crises of our time demand transformative educational leadership (UNESCO, 2017; Christ and Sommer, 2023). Education is increasingly recognized as a crucial driver for societal transformation, particularly through Education for Sustainable Development (ESD), which is embedded in the United Nations' Sustainable Development Goals (SDGs), most notably Goal 4.7 on Quality Education. ESD aims to equip learners with the competencies, values, and knowledge required to contribute to a more sustainable future (Vare and Scott, 2007; Singer-Brodowski and Kminek, 2023; United Nations, 2023).

Within this global agenda, educational leaders are increasingly seen as pivotal agents of change. Their role extends beyond administrative functions to shaping school development, curriculum, and culture in alignment with sustainability principles (Gericke and Torbjörnsson, 2022; Mogren and Gericke, 2019). To support this transformation, the Whole School Approach (WSA) provides a comprehensive framework for integrating sustainability throughout all aspects of school life (Wals and

Mathie, 2022; Gericke et al., 2024). However, the implementation of ESD through WSA often remains fragmented, frequently limited to isolated environmental or project-based initiatives (Stricker et al., 2023; Borg et al., 2025).

Despite progressive policy frameworks, school leaders continue to face considerable barriers. These include limited time and resources, rigid administrative structures, and conceptual ambiguity around what ESD actually entails in everyday school practice (Zachariou and Kadji-Beltran, 2009; Müller et al., 2021). At the same time, successful implementation of ESD has been linked to participatory and distributed leadership models as well as the personal commitment of leaders to sustainability values (Leo and Wickenberg, 2013; Verhelst et al., 2021; Ralebese et al., 2025).

However, in the German context, particularly at the school leadership level, empirical studies remain scarce. While international scholarship highlights the importance of leadership in systemic ESD implementation, we know little about how school leaders in Germany perceive their role within this process and how they navigate the institutional constraints they face (Stricker et al., 2023; Gericke, 2022).

This article addresses this gap by exploring how school leaders in the federal state of Baden-Württemberg, Germany, understand and enact their role in the holistic implementation of ESD, with particular attention to the tensions between personal commitment and systemic constraints.

2 Theoretical background

The following section outlines the conceptual foundations of this study and situates it within the broader academic discourse on ESD and educational leadership. It begins by defining ESD and its pedagogical aims, followed by an exploration of the WSA as a holistic framework for embedding sustainability in educational institutions. Subsequently, the section examines the role of school leadership in the context of ESD implementation, with a particular focus on leadership styles and role perceptions. The final sub-section identifies the research gap addressed by this study, highlighting the lack of empirical insight into how German school leaders interpret and enact their responsibilities in advancing ESD through a whole-school lens.

2.1 Education for sustainable development (ESD)

ESD seeks to equip learners with the knowledge, skills, values, and attitudes necessary to contribute to a sustainable future. Defined by UNESCO as an integral component of quality education and central to achieving the SDGs, ESD encompasses ecological, social, and economic dimensions of sustainability. It promotes lifelong learning and encourages individuals to engage in informed decision-making and responsible actions that safeguard environmental integrity, promote economic viability, and ensure social justice for current and future generations (UNESCO, 2020; United Nations, 2023).

The scholarly discourse distinguishes between two approaches: ESD 1, which emphasizes instrumental, goal-oriented learning outcomes (e.g., climate-friendly behavior), and ESD 2, which favors an emancipatory, transformative model that fosters critical

thinking, autonomy, and participation in shaping a sustainable world (Vare and Scott, 2007; Singer-Brodowski and Kminek, 2023). In practice, both perspectives often coexist, and scholars have called for both their integration into educational systems (Albers, 2022; Rieckmann, 2021).

Despite its growing recognition, the implementation of ESD in schools remains inconsistent. Research highlights a gap between policy ambitions and practical realities in educational institutions (Christ and Sommer, 2023; Mogren and Gericke, 2019). Challenges include a lack of clarity regarding ESD's goals, fragmented integration into curricula, and inadequate teacher training. The political framing of ESD and its potential to reproduce existing societal inequalities has also been critically examined (Mogren and Gericke, 2019).

In Germany, ESD is formally embedded in school curricula, notably in the federal state of Baden-Württemberg, where it is defined as a guiding educational principle across all subjects and all types of schools. However, studies have shown that its interpretation and application are often superficial or limited to environmental themes, failing to embrace its actual transformative potential (Stricker et al., 2023). This signals a need for more comprehensive models that integrate ESD into the broader culture and operational structure of schools—thus leading to the relevance of the WSA.

2.2 The Whole School Approach (WSA)

The Whole School Approach (WSA) has gained increasing prominence as a guiding framework for embedding ESD into all aspects of school life (Mathie, 2024). It represents a systemic and holistic model that aims to transform schools into environments where sustainability is not only taught but actively practiced, lived, and reflected across curricula, governance, culture, and community partnerships.[1]

WSA draws on the broader theoretical construct of the Whole Institution Approach (WIA), which emphasizes coherence between the formal, informal, and non-formal dimensions of education (Gericke, 2022). The approach moves beyond isolated sustainability initiatives or extracurricular projects by seeking to integrate ESD values into the entire operational and pedagogical structure of the school. This includes leadership strategies, teaching methodologies, organizational culture, infrastructure management, and connections with the local community (Gericke, 2022; Wals and Mathie, 2022).

A widely recognized representation of this approach is the WSA Flower Model, developed by Wals and Mathie (2022, 2024). This model captures the interconnectedness of six key components

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1 In this article, we use the term Whole School Approach (WSA) to refer to the application of the Whole Institution Approach (WIA) within school contexts. While WIA is the broader term employed in international policy and research to encompass all educational institutions (including higher education and non-formal settings), WSA is commonly used in school improvement literature and among practitioners to describe systemic, school-wide engagement with ESD. For clarity and contextual relevance, we adopt "WSA" when discussing school-level implementation, while recognizing it as a specific manifestation of the WIA framework (cf. Gericke, 2022; Wals and Mathie, 2022).

essential for embedding sustainability in school structures and practices:

1 Vision, Ethos, Leadership, and Coordination—Central to the model, this element ensures that the entire school operates under a shared sustainability vision and coherent leadership strategy.
2 Curriculum—Sustainability is embedded in curricular content, across subjects, encouraging interdisciplinary and transdisciplinary learning.
3 Pedagogy and Learning—Emphasizes participatory, experiential, and transformative learning methodologies that engage students as active participants.
4 Institutional Practices—Sustainability principles are integrated into the school's day-to-day operations, from resource use to health and well-being practices.
5 Community Connections—Encourages partnerships with parents, local organizations, and broader societal stakeholders to extend sustainability learning beyond the classroom.
6 Capacity Building and Professional Development—Supports ongoing learning for staff to develop sustainability competencies and leadership skills.

What distinguishes the WSA Flower Model from more fragmented, linear, or curriculum-focused approaches is its cyclical and integrated logic. Rather than treating its six components as discrete or sequential steps, the model views them as dynamic and mutually reinforcing (see Figure 1). This holistic configuration supports the co-construction of a sustainability culture within schools, emphasizing system-wide participation, leadership coordination, and continuous learning (Wals and Mathie, 2022, 2024; Gericke et al., 2024). And while the model places "Vision, Ethos, Leadership, and Coordination" at the center, this position reflects its coordinating and integrative role rather than hierarchical dominance. All six components are interdependent and equally essential for systemic transformation toward sustainability (Mathie, 2024).

FIGURE 1
The whole school approach flower model (Wals and Mathie, 2022, p. 4).
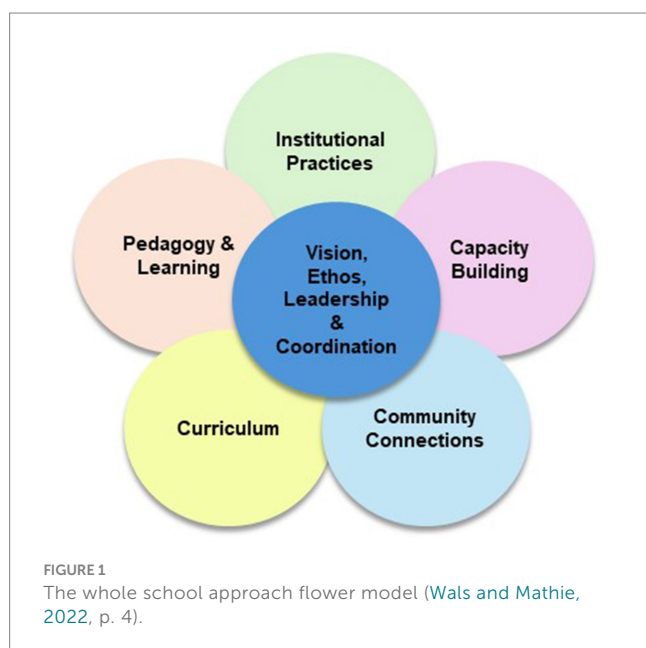
While WSA has proven effective in international contexts—particularly in Nordic countries (Forssten Seiser et al., 2022; Borg et al., 2025)—implementation challenges remain, especially in education systems characterized by centralized governance and bureaucratic inertia. Studies by Gericke and Torbjörnsson (2022) emphasize that implementation requires not only vision but also the continuous negotiation of shared goals, trust-building, and strategic management. External pressures, rigid educational structures, and limited resources often hinder long-term institutionalization. (Borg et al., 2025). In Germany, ESD is formally included in curricula (e.g., as a "Leitperspektive" in Baden-Württemberg[2]), but the practical application of WSA principles is uneven and often limited to short-term environmental initiatives rather than systemic change (Stricker et al., 2023). Although the WIA is conceptually supported through policy frameworks such as the UNESCO-led ESD strategy, its translation into everyday school practice is often fragmented or symbolic. Some initiatives offer promising steps toward project-based engagement with sustainability but fall short of a full WSA unless they are embedded across all school domains. Thus, while WSA provides a vision for sustainability in education, its success is contingent on leadership capacity, contextual adaptation, and systemic support—points that are examined further through the lens of school leadership in the next section.

2.3 School leadership and ESD

School leadership is widely recognized as a key enabler of whole-school change and a critical factor in the successful implementation of ESD. In both research and policy, school leaders are increasingly conceptualized not just as administrators, but as "change agents" who influence values, norms, and practices within the school community and drive strategic school development aligned with sustainability principles (Huber, 2019; Verhelst et al., 2021). Within this literature, two dimensions of leadership have emerged as particularly influential in shaping ESD outcomes: leadership style and personal engagement with sustainability.

A substantial body of research has explored the impact of different leadership styles on ESD implementation. In particular, transformational leadership—which emphasizes vision-building, collaboration, and inspiration—and distributed leadership—which focuses on shared responsibility and capacity building—are often seen as compatible with the participatory and systemic ethos of the WSA (Leo and Wickenberg, 2013; Mogren and Gericke, 2019). These models tend to support inclusive school cultures, enable teacher agency, and foster long-term engagement with sustainability goals.

In contrast, instructional leadership, which prioritizes curriculum management, goal-setting, and performance monitoring, reflects a more centralized and accountability-driven model. While such an

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2 The term Leitperspektive (cross-cutting perspective) refers to overarching educational objectives integrated into all subjects and grade levels in the curriculum of Baden-Württemberg. The Leitperspektive Bildung für nachhaltige Entwicklung (BNE [ESD]) designates ESD as a guiding principle to be addressed across disciplines, aiming to promote sustainability competencies in all areas of learning.

approach can be effective in aligning teaching practices with external reforms, it may lack the openness and cultural adaptability needed to embed ESD as a transformative, school-wide project. As Ralebese et al. (2025) argue, instructional leadership may support policy implementation and curricular fidelity, but often sidelines interdisciplinary, student-centered, and cross-curricular initiatives essential for holistic sustainability education.

This tension becomes particularly visible in the implementation of programs such as FreiDay (eng. free, independent day)—a pedagogical concept that encourages students to engage with sustainability challenges through interdisciplinary, project-based learning. FreiDay aligns closely with the WSA and relies on leadership support for flexible timetabling, teacher collaboration, and a culture of experimentation. In this context, schools led by transformational or distributed leaders are often more open to FreiDay's integrative logic, while those governed by more managerial or instructional models may struggle to accommodate its demands within existing structures.

Alongside leadership style, research has identified personal engagement with sustainability topics as a decisive factor in shaping leadership practice. Müller et al. (2021) found that school principals who demonstrated a strong personal conviction about sustainability were more likely to champion ESD initiatives—even in the absence of institutional mandates. Similarly, Borg et al. (2025) showed that eco-certified schools often benefited from leaders with a holistic and nuanced understanding of ESD, while non-certified schools frequently lacked such leadership vision and commitment. These findings suggest that leadership for sustainability cannot be reduced to structural position or management practice alone—it also depends on individual values and a willingness to take initiative within existing constraints.

Nonetheless, even personally committed and pedagogically visionary school leaders operate within complex institutional environments. Bureaucratic constraints, staffing shortages, limited budgets, and vague or inconsistent policy guidance can significantly limit their capacity to initiate and sustain meaningful change (Gericke and Torbjörnsson, 2022). In the German context, these challenges are compounded by the federal structure of education and a general lack of school autonomy, both of which restrict local decision-making and make systemic transformation particularly difficult (Stricker et al., 2023).

2.4 Research gap

Despite broad international agreement on the importance of sustainability in education, the implementation of ESD through a WSA remains uneven and under-theorized—particularly in the German school system. Although policy frameworks such as UNESCO's ESD Roadmap and Baden-Württemberg's curricular mandate to embed ESD ("Leitperspektive BNE") provide formal endorsement, their translation into everyday school practice often lacks coherence and depth (Holst, 2023; Wals and Mathie, 2022).

Existing research has identified strong leadership, collaborative school culture, and professional development as critical enablers of WSA implementation (Gericke et al., 2024; Forssten Seiser et al., 2022). However, school leaders frequently operate in environments shaped by top-down policy pressures, fragmented mandates, and a lack of clarity about what ESD entails in pedagogical and organizational terms (Zachariou and Kadji-Beltran, 2009; Mogren and Gericke, 2019). As a result, sustainability initiatives are often confined to isolated environmental projects rather than integrated into systemic school development aligned with the six interdependent WSA components.

In Germany, few studies have examined how school leaders actually understand and enact their role in advancing sustainability. The limited empirical work available often conflates formal responsibilities with personal engagement, without critically examining how leadership intentions are translated—or blocked—in daily practice (Stricker et al., 2023). While concepts like FreiDay represent emerging pedagogical strategies that align with WSA principles, little is known about the institutional and leadership conditions that enable or inhibit their adoption. This points to a significant gap in the literature: while school leadership is widely acknowledged as a driver of sustainability in education, we lack empirical insight into how leaders interpret and enact their role in whole-school ESD implementation—particularly in relation to the tension between personal motivation and institutional limitations.

This study seeks to address this gap by asking the following research question: How do school leaders in Baden-Württemberg perceive and enact their role in the holistic implementation of ESD within their schools?

By examining their narratives across key dimensions of leadership, curriculum, vision, communication, and resources, the study offers grounded insight into the practices that shape, enable, or constrain sustainability-oriented school development.

3 Methodology

To explore how school leaders perceive their role in the holistic implementation of ESD, this study employed a qualitative research design. The research focused on uncovering nuanced perspectives of school leadership concerning ESD-related school development within the specific context of Baden-Württemberg, Germany.

3.1 Instruments, interview conduct, and data management

A semi-structured interview guide was developed, comprising 14 main questions, divided between themes of ESD and teacher well-being (the latter forming part of a parallel master's thesis project). The ESD-related questions addressed key areas including participants' understanding of ESD, ongoing sustainability-related projects, school development strategies, and leadership approaches. The guide was developed based on the theoretical framework of the WSA and a review of existing literature on ESD leadership. To ensure content validity and clarity, the interview guide was reviewed by a panel of three experts in ESD and educational research and subsequently approved by the ethics committee of the Karlsruhe Institute of Technology (KIT). A pilot interview was conducted

with a school leader not included in the final sample. Based on feedback from the pilot and expert reviewers, minor adjustments were made to clarify wording and improve question flow before final data collection began. The full interview guide is available upon request.

Interviews were conducted between June and July 2024 using a variety of formats—video conferencing, telephone, and in-person sessions—depending on participant availability and preference. All sessions were audio-recorded using "Open Broadcaster Software." The average interview duration was 49 min, with the shortest interview lasting 37 min and the longest extending to 78 min. The recordings were transcribed using artificial intelligence services provided by "audiotranskription— dr. dresing and pehl GmbH." Data protection and anonymity were prioritized throughout: names and location-specific references were replaced during transcription to safeguard participant identities.

3.2 Participants

This study employed a qualitative, cross-sectional research design. The study employed a convenience sampling approach, recruiting school leaders from across various school types in Baden-Württemberg. Eleven individuals participated, including ten principals and one deputy principal (seven male, four female). The sample represented a diverse range of school formats: Realschulen (intermediate secondary schools), Gymnasien (academic-track secondary schools), a community school, and a vocational school. Table 1 shows an overview of the sample.

Semi-structured interviews were conducted with all school leaders. The interviews followed a detailed guideline addressing perceptions of ESD, experiences with implementation, and views on concepts such as the FreiDay project. Thematic analysis, as proposed by Braun and Clarke (2006, 2023), guided the data analysis, enabling the identification of patterns across participants' narratives.

3.3 Data analysis

Thematic analysis, as proposed by Braun and Clarke (2006, 2023), served as the analytical framework for this study. The overarching analytical goal was to identify recurring themes in how school leaders conceptualize and enact their role in ESD-oriented school transformation, paying particular attention to the barriers and opportunities for systemic change. The coding process followed a hybrid approach, combining deductive and inductive strategies. Deductively, initial codes were informed by the six components of the WSA Flower Model (Wals and Mathie, 2022), including leadership, curriculum, pedagogy, institutional practices, community connections, and professional development. Inductively, these were adapted and refined through close engagement with the interview data.

All transcripts were imported and coded using MAXQDA 2024, a qualitative analysis software that supported the systematic organization, retrieval, and comparison of coded data segments. This tool allowed for transparent traceability of the coding process and ensured analytical rigor. The second author conducted the initial round of coding, which was then discussed and refined in consultation

with the broader research team to enhance credibility and reduce interpretive bias. The coding and analysis proceeded through five stages:

- Familiarization: Transcripts were read and annotated by the first author to identify patterns and points of interest.
- Initial Coding: Both deductive codes (based on the WSA) and inductive codes (emerging from the narratives) were applied.
- Theme
- Development: Codes were grouped into sub-themes and higher-order themes.
- Team Discussion: Thematic categories were discussed and revised in research team meetings.
- Refinement: A second round of coding was conducted to ensure internal coherence across themes.

The final analytical categories were narrowed to five core dimensions: vision, resources, curriculum, leadership, and communication (Figure A1). These reflect both deductively derived categories based on the WSA and the themes most consistently and richly developed in participants' accounts. While elements of pedagogy and professional development were occasionally referenced, they did not emerge with sufficient depth to warrant separate thematic categories.

In addition to these five core dimensions, one cross-cutting theme—understanding of ESD—was identified inductively during the coding process. Although not originally part of the WSA framework, it became clear that school leaders' conceptualizations of ESD shaped how they engaged with all other dimensions. As such, this theme is presented first in the findings section to provide context for interpreting the remaining categories.

To ensure clarity and fidelity to the original expressions, all quotations used in the analysis were translated from German to English by the first author and reviewed to preserve meaning and tone, following best practices in qualitative translation (Denzin and Lincoln, 2018). In the findings, participants are referenced by ID codes (e.g., S07), which correspond to the school leaders listed in Table 1. This allows readers to understand the school type and background of each speaker while preserving anonymity. Representative coding examples for each analytical theme are provided in Table A1, using the theme of "Vision" to illustrate the coding structure and interpretative process.

4 Findings

The findings are organized into six thematic areas: understanding of ESD, vision, leadership, curriculum, resources, and communication. The first theme—understanding of ESD—emerged inductively and is presented upfront due to its foundational relevance. It captures the varied and often incomplete ways in which school leaders interpret the concept of sustainability in education, which in turn informs how they approach school development, leadership, and implementation practices. The remaining five themes are based on the analytical framework derived from WSA. Each subsection below highlights how school leaders describe, negotiate, and at times struggle with embedding sustainability in their schools—offering insight into both enabling conditions and persistent barriers to whole-school transformation.

TABLE 1 Overview of interviewed school leaders.

School leader-ID	Sex	School type	Estimated students/teachers	Interview duration (min)
S01	Male	Intermediate secondary school	550/45	39
S02	Male	Academic-track secondary school	1000/N.N.	45
S03	Male	Academic-track secondary school	875/82	54
S04	Female	Academic-track secondary school	650/55 (1300/120)	48
S05	Male	Academic-track secondary school	560/85	46
S06	Male	Academic-track secondary school	420/45	49
S07 (Vice Principal)	Female	Intermediate secondary school	900/70	78
S08	Male	Community School (intermediate and academic-track secondary school)	1200/100	37
S09	Female	Intermediate secondary school	390/36	46
S10	Male	Vocational school	1350/135	47
S11	Female	Academic-track secondary school	780/N.N.	54

4.1 Understanding of ESD

The interviews revealed a broad range of understandings of ESD among school leaders. While most participants expressed openness toward the topic and general support for sustainability in schools, the interpretations they offered varied widely in clarity, scope, and coherence.

Some school leaders articulated a multidimensional view of ESD. For instance, S04 offered a comprehensive understanding that aligns with UNESCO's holistic definition:

> *"Sustainable development includes aspects of health, social, ecological, and economic issues. Sustainability actually covers many areas." (S04)*

Others referenced sustainability more pragmatically, often associating it primarily with environmental protection or isolated initiatives. These participants tended to name activities such as waste separation for recycling, energy-saving measures, or school gardening. While this environmental focus was not always explicitly contrasted with social or economic dimensions, it marked a narrower conception of ESD (S01, S02, and S05). Other school leaders struggled to define ESD clearly or admitted to not being fully familiar with the term. As S07 put it: *Honestly, I think it's difficult right now to define it exactly for us."* (S07).

Others acknowledged that the concept had not yet been meaningfully integrated into strategic processes. S10, for example, pointed to the lack of systemic anchoring in the sense of ESD being present in school projects and extracurricular activities, but not embedded as a guiding principle for school development. S06 noted that sustainability is addressed in multiple ways at the school, but stopped short of describing a coordinated, whole-school effort.

In sum, while there was widespread recognition that sustainability is important, there was no shared or consistently articulated understanding of what ESD entails. Only a few participants described ESD in its full breadth—including its transformative, cross-sectoral, and participatory character. A shared challenge across the interviews was the difficulty in translating ESD into a clear, institution-wide strategy.

4.2 Vision

The identified theme of "vision" revealed divergent levels of conceptual clarity and strategic intent regarding ESD among the school leaders. While all respondents valued the notion of sustainability, few described a shared, forward-looking, and institutionally embedded vision that guided long-term school development.

Only one participant, S03, explicitly referred to a structured process of vision development. He reported plans to initiate a formal revision of the school's mission statement, which was perceived as outdated and disconnected from current educational priorities:

> *"What is necessary, in my opinion, is the development of a new school mission statement. The current one is outdated and no longer lived. I believe sustainability needs to be much more strongly anchored in it than it [currently] is." (S03)*

Other school leaders, such as S06 and S10, emphasized the importance of a sustainability vision in principle but acknowledged significant structural and temporal limitations to developing or enacting one. For instance, S10 expressed that while sustainability is viewed as important, there is not enough time to operationalize it. Another interview partner, S09, described a strong school identity around values like democracy and tolerance, and while these were recognized as thematically linked to ESD, the leader noted that these connections had not yet been formalized into a strategic vision.

At another school, S07 explained their decision to implement a sustainability-related project independently of national networks like FreiDay. This autonomy was seen as critical to shaping a locally grounded vision of sustainability:

> *"We want to take time as a school to explore how we can emphasize sustainability based on our own ideas and priorities—without relying on external labels or structures." (S07)*

Taken together, the findings indicate that while school leaders supported sustainability in principle, few had yet translated this into a cohesive institutional vision. Vision work, where it occurred, was

often reactive or emergent—embedded in project-based learning, teacher-led initiatives, or curriculum experiments, rather than expressed through explicit strategic frameworks or whole-school identity formation.

4.3 Leadership

We identified leadership as an expansive and significant theme towards answering our research question. School leaders described a variety of leadership roles and strategies in relation to ESD implementation, spanning from directive approaches to more distributed and facilitative styles. S02 described the role of school leadership as multifaceted: *"You're a bit of an initiator, an enabler, and sometimes a brake when there's no other way" (S02).*

Similarly, S11 noted that setting themes for the year is part of their leadership practice. At the same time, she emphasized the importance of delegation and collaboration and highlighted how responsibilities and tasks were distributed among staff: *"These are all impulses I can provide. Beyond that, I delegate a lot to my departments" (S11).* S08 echoed this approach, stressing the necessity of teamwork *"because one person alone absolutely cannot handle it."*

Some leaders emphasized symbolic or motivational leadership. S10 described the role as primarily indirect, placing importance on visible support and symbolic acts:

> *"That means showing you stand behind the issue and don't just dismiss it as some whim from [the ministry]." (S10)*

S07, meanwhile, preferred a persuasive approach over coercion in a strategy of *"convincing [the staff] with real results."*

A few leaders also noted the challenges of navigating hierarchical systems. S04 described the need to act as a mediator between top-down mandates and local school realities. Leaders like S06 and S09 stressed their accountability for enabling and coordinating sustainable initiatives within the school. Others such as S01 emphasized maintaining a holistic perspective and ensuring external collaboration:

> *"School leadership should always see the big picture […] creating networks, being a point of contact." (S01)*

While many leaders described their role as one of mediation or buffering within rigid systems, several also expressed a clear desire to move forward proactively—often in collaboration with staff or students. For instance, S03 reported plans to revise the school's mission statement in order to explicitly integrate sustainability values, framing this as a strategic step toward long-term change. S07 emphasized the importance of developing an internal, school-specific sustainability vision rather than adopting external programs uncritically. S08 highlighted the role of student participation in shaping initiatives, describing co-construction as a key leadership responsibility.

In sum, the interview data reveal a range of leadership enactments—from top-down goal-setting and resource control to empowerment, symbolic endorsement, and buffering systemic constraints. Most school leaders demonstrated awareness of their formal role, but varied considerably in how actively or strategically they engaged with ESD-related leadership tasks.

4.4 Curriculum

Curriculum emerged as a central, yet contested, space for the implementation of ESD. While all school leaders acknowledged that ESD is formally anchored in Baden-Württemberg's education policy as a "Leitperspektive," most described the practical integration of these principles as limited or obstructed by institutional structures.

Several school leaders (S03, S05, and S09) highlighted how the dominance of subject-specific instruction (Fachunterricht) and rigid timetabling hinder interdisciplinary or project-based approaches. One interview partner voiced concern about establishing new weekly formats like FreiDay:

> *"Because of subject teaching and the subject-teacher principle, I see major organizational difficulties in setting up a regular project day each week." (S05)*

Another school leader described how resistant the system can be—even when trying to shift a single lesson:

> *"You wouldn't believe the struggle it takes to shift even one lesson. With FreiDay, I have to give it up entirely." (S03)*

These structural constraints were not seen as merely logistical, but also symbolic of a school culture overly centered on content delivery rather than competency development (S04, S09). At the same time, a few leaders pointed to curricular reforms as potential entry points for ESD. S11 referred to upcoming guidelines that would embed BNE into geography instruction. Some leaders also emphasized the need to challenge dominant instructional formats. S09, for instance, advocated for alternative pedagogies and criticized the current lesson structure, demanding *"different teaching formats—away from the 45-min lesson cycle."*

More optimistic views were expressed in schools where FreiDay had been implemented or was planned. S01 discussed re-engaging a retired teacher specifically to support the FreiDay format. Despite some isolated examples of innovation, however, most school leaders (S02, S04, and S06) emphasized that time pressures, performance expectations, and rigid subject boundaries limited their capacity to treat ESD as more than a thematic supplement. The ideal of embedding sustainability across curricula was widely supported, but its realization remained hindered by systemic inertia.

4.5 Resources

Across all interviews, school leaders consistently cited the scarcity and rigidity of resources—human, financial, and spatial—as major challenges to implementing ESD in a holistic and sustained way. Resource limitations shaped both the feasibility and depth of ESD activities and often forced pragmatic trade-offs with curricular or staffing demands.

Personnel shortages emerged as the most critical bottleneck. Several school leaders (S02, S05, S06, and S07) described acute staff shortages that frequently disrupted even basic lesson coverage, let alone capacity for project-based or sustainability-focused initiatives. As S02 put it:

> *"I don't have the people. […] That could lead to me deciding to suspend the extracurricular group in order to allow the staff I do have to recover."*

To compensate, some schools employed retired teachers (S01, S06) or individuals without formal teaching credentials (S06, S07). S06 described their reliance on non-certified staff as essential to maintaining lesson coverage. S07 additionally highlighted distortions in personnel planning, noting that chronically absent staff were still counted as available by school authorities—even though hiring decisions were not within the school's own control. This further exacerbated planning difficulties and limited flexibility in resource allocation.

Financial constraints were another widespread concern. While S02 emphasized that not every initiative required major funding, others, such as S05, S08, and S10, described budget limitations and administrative hurdles as systemic barriers to sustainable school development. S03 reported lengthy waiting times when applying for funding. S10, meanwhile, called for greater financial autonomy at the school level:

> *"I want to be able to decide—to actually make strategic decisions. Currently, principals have far too little decision-making power." (S10)*

Spatial limitations—especially for hands-on or group-based projects—were also noted. S09 mentioned the lack of creative spaces as an obstacle to participatory sustainability education. Finally, resource challenges often intersected, creating cumulative effects. Staffing gaps limited extracurricular groups, which in turn constrained student engagement with sustainability. Nonetheless, some leaders adapted creatively. S01, for instance, brought back a retired teacher to support a FreiDay initiative:

In sum, although school leaders demonstrated adaptability and personal commitment, the consistent lack of human, financial, and spatial resources presented significant barriers to the systemic implementation of ESD. Structural change and institutional support were seen as prerequisites for overcoming these constraints.

4.6 Communication

Communication emerged as a necessary yet often underdeveloped dimension of ESD-related school leadership. While not a primary focus for any school leader, all participants referenced communication as integral to their role—particularly regarding coordination, transparency, and internal alignment. Internally, school leaders such as S01, S09, S10, and S11 emphasized their responsibility to inform, structure, and motivate the school community. As S09 described:

> *"[My task is] basically, to bring these ideas to the staff, to establish a structure that makes them feasible." (S09)*

To mitigate communication overload, some school leaders established specific routines. For instance, S04 introduced a weekly email strategy:

> *"Every Monday we send one email with all relevant information for the week […] and only this one message from the school leadership."*

However, S04 also noted the limits of regulation, citing internal disputes about off-hours communication. Despite a communication window (08:00–18:00), teachers often diverged, leading to tension over personal boundaries and expectations. S10 stressed the need for early and structured communication, citing both formal and informal channels as necessary to support planning and shared commitment.

Externally, communication was generally reactive. Some leaders viewed student engagement as a more direct and effective lever than parental outreach. S10 exemplified this by deliberately prioritizing student communication. S08 further described co-constructing ESD initiatives like an "environmental day" with student representatives, stressing participatory communication as part of the school's learning culture.

A minority of leaders also referenced cooperation with external actors. S05, for example, cited connections to universities like the Hector Institute and School of Education, while S07 stressed the importance of including facility staff in project coordination.

In sum, school leaders positioned communication as both a logistical necessity and a potential enabler of change. However, most still treated it as a support function rather than a strategic driver of school transformation.

5 Discussion

This study set out to explore how school leaders in Baden-Württemberg perceive and enact their role in the holistic implementation of ESD, with particular reference to the WSA. Using a qualitative design and thematic analysis, we identified five dimensions—vision, leadership, curriculum, resources, and communication—as well as individual understandings of ESD to being central to leadership practice in this context. These findings contribute to a deeper empirical understanding of how ESD is interpreted and operationalized at the school leadership level in Germany, while also raising important questions about the structural and cultural conditions needed to support systemic transformation.

5.1 From environmental projects to systemic vision?

The findings illustrate that most school leaders understand ESD as important, but their interpretations remain fragmented and often environmentally focused. Only a minority articulated a multidimensional understanding of ESD encompassing social, ecological, and economic dimensions (e.g., S04). This reflects prior literature noting that ESD is frequently reduced to isolated initiatives rather than embedded as a cross-sectoral transformation strategy (Stricker et al., 2023; Zachariou and Kadji-Beltran, 2009).

The prevalence of ESD 1-type practices—such as energy-saving measures or waste separation—highlights that instrumental, behavior-oriented approaches are often more feasible within the current structures of school organization. Indeed, such practices can serve as important entry points for ESD, particularly in systems where time, autonomy, and resources are constrained. At the same time, the limited articulation of ESD 2 elements—such as critical thinking, agency, and structural change—indicates that the transformative ambitions of ESD remain difficult to realize at the leadership level, despite policy frameworks encouraging them. Rather than positioning ESD 1 and ESD 2 in opposition, our findings affirm the challenge of developing integrative approaches that combine both perspectives in meaningful ways.

This gap is further evidenced by the underdevelopment of sustainability "vision" across the sample. While several leaders expressed a general commitment to ESD, few had formalized this into a shared institutional vision or embedded it within school development plans. The centrality of "Vision, Ethos, Leadership, and Coordination" in the WSA Flower Model (Wals and Mathie, 2022) is thus not mirrored in practice. The findings suggest that vision-setting, while valued, is rarely accompanied by the structural or collaborative mechanisms needed to make it durable. In several cases, leaders noted that vision work remained informal, emergent, or dependent on individual actors rather than being co-constructed with the school community. This reinforces the argument that vision-setting, though vital, remains fragile unless it is institutionally supported, strategically embedded, and collaboratively developed across stakeholder groups.

5.2 Leadership between aspiration and constraint

A notable contribution of this study is its nuanced documentation of how leadership is enacted—not only as a formal role but as a balancing act between motivation, delegation, and constraint navigation. Most leaders emphasized their responsibility as coordinators, buffers, or motivators rather than as direct implementers of sustainability (e.g., S01, S04, and S10). This aligns with the WSA's emphasis on participatory and distributed leadership (Gericke et al., 2024; Leo and Wickenberg, 2013), yet also complicates it: in many cases, leadership engagement was informal, reactive, or symbolic, rather than strategic and systemic.

The findings suggest that transformational and distributed leadership orientations—commonly advocated in ESD literature—coexist with elements of instructional and managerial approaches. For example, S11 emphasized agenda-setting and monitoring yearly themes, reflecting instructional tendencies. This mirrors Ralebese et al.'s (2025) observation that instructional leadership may support curriculum-focused reform but often lacks the transformative scope needed for holistic ESD.

Importantly, personal engagement with sustainability remained a decisive factor. Leaders who described themselves as personally committed (e.g., S10, S07) appeared more willing to invest time and resources in ESD, even in the face of structural barriers. Notably, one participant (S03) described plans to revise the school's mission statement in order to more explicitly integrate sustainability values. This suggests that, while rare, strategic visioning aligned with ESD is possible even within Germany's highly structured education system.

However, such examples were the exception rather than the norm. This finding supports Müller et al. (2021) and Borg et al. (2025), who note that school-level change often hinges on the internalized values and motivations of individual leaders rather than institutional mandates alone.

5.3 Curriculum and resource dilemmas

The curriculum was identified as both a carrier and a constraint for ESD. While ESD is formally included as a "Leitperspektive" in Baden-Württemberg, most participants viewed subject compartmentalization and time constraints as major obstacles. The critical stance of some leaders (e.g., S05, S03, and S09) toward rigid subject structures reflects broader concerns in the literature about the incompatibility between ESD's integrative aims and conventional curriculum models (Christ and Sommer, 2023; Mogren and Gericke, 2019).

The FreiDay model emerged as a revealing example: while seen as an inspiring initiative, it was often perceived as difficult to integrate into existing timetables or staff routines. This suggests that even pedagogical formats well-aligned with WSA remain vulnerable to systemic inertia unless leadership is empowered to implement structural innovation.

These challenges were compounded by significant resource limitations—particularly in staffing, space, and financial autonomy. Many school leaders (e.g., S02, S06, and S09) described difficult trade-offs between core instructional demands and sustainability activities. These findings align with international research showing that resource constraints, when coupled with limited decision-making authority, significantly curtail the potential for ESD integration (Gericke and Torbjörnsson, 2022; Forssten Seiser et al., 2022).

5.4 Communication as a lever for participation

Communication was widely recognized as essential but rarely treated as a strategic leadership tool. Internal communication practices focused on coordination and efficiency, while dialogic and participatory strategies were less frequently mentioned. Only few school leaders gave examples of involving students in co-constructing sustainability initiatives—a practice that aligns closely with ESD 2 and the WSA's ethos of co-agency.

Externally, communication with parents and community partners appeared inconsistent and often dependent on school type and context. While some school leaders described efforts to build partnerships with universities, NGOs, or local institutions (e.g., S05), others placed less emphasis on engaging parents—particularly in settings where students were older or more autonomous, such as vocational schools. In this case, students were viewed as the primary audience and drivers of change, with parental involvement seen as less relevant or necessary. This variation reflects both contextual realities and differing leadership priorities. While strong student engagement is a cornerstone of transformative ESD, limited interaction with the broader community may restrict opportunities for co-construction, shared ownership, and long-term sustainability of school development processes.

5.5 Reframing role perception and enactment

A core insight of this study lies in its focus on how leaders perceive their role in ESD—an angle underrepresented in German-language research to date. While some leaders displayed high ownership and strategic orientation, many saw themselves as constrained actors working within bureaucratic and cultural limitations. This echoes Ralebese et al. (2025), who emphasize the need to differentiate between role perception and actual enactment. Future research should investigate how these perceptions translate into institutional change—or fail to do so—especially in systems with limited autonomy like Germany's (Wohlfart et al., 2026).

A core insight of this study lies in its focus on how school leaders perceive and enact their role in advancing ESD—an angle underrepresented in German-language research to date. While some leaders demonstrated a strong sense of ownership and strategic intent, others saw themselves primarily as constrained actors navigating bureaucratic structures and entrenched school cultures. Notably, subtle differences emerged between school types: leadership in the intermediate secondary schools often reflected a more pragmatic and resource-conscious approach, whereas leaders in academic-track secondary schools were somewhat more likely to articulate ESD as part of a broader pedagogical or institutional vision. This supports the argument by Ralebese et al. (2025) that role perception and role enactment must be analytically distinguished. Future research should explore how these dynamics play out across different school types and how leadership perceptions translate into institutional change—or fail to—especially in systems with limited autonomy like Germany's (Wohlfart et al., 2026).

5.6 Implications and open questions

These findings point to several key implications:

- First, leadership training may explicitly engage with the WSA as a whole-school development framework and equip leaders to articulate a shared vision of sustainability.
- Second, structural support to foster ESD is needed—not only through funding but also through policy leeway that allows for timetable innovation and cross-curricular integration.
- Third, schools need professional development that includes pedagogical tools and leadership strategies for fostering participatory sustainability cultures.

Taken together, the five thematic dimensions emerging from this study—vision, leadership, curriculum, resources, and communication—closely mirror key components of the WSA as conceptualized in the Flower Model (Wals and Mathie, 2022). However, two components—pedagogy and learning as well as professional development and capacity building—were mentioned only marginally in participants' narratives and did not emerge as standalone themes. This suggests that while school leaders actively engage with structural and organizational aspects of ESD implementation, pedagogical transformation and staff development remain underemphasized in leadership discourse.

Rather than replacing the WSA framework, our empirical focus highlights the uneven operationalization of its six interdependent elements in practice. It also offers a basis for targeted reflection: identifying which dimensions are already addressed by school leadership and where further capacity-building may be required. Future implementation strategies might use the WSA model not only as a design framework but also as a diagnostic tool—helping schools assess where leadership engagement is already strong and where systemic blind spots persist.

Open questions remain: How do teachers and students experience leadership for ESD? To what extent do vision and leadership style shape long-term institutional culture? What are the effects of decentralized versus centralized support systems on WSA enactment?

5.7 Limitations

We acknowledge several limitations of our study, which, while grounded in qualitative methodology and offering rich, context-specific insights, nonetheless shape the scope and transferability of our findings. First, the study is based on a small and regionally bounded sample of eleven school leaders from Baden-Württemberg. While the sample includes a diversity of school types and leadership experiences, it does not allow for broad generalizations across all German federal states or school systems. Institutional dynamics, policy frameworks, and leadership practices may vary significantly in other states or international contexts. Second, the data reflect self-reported perceptions rather than direct observations of leadership practices or institutional outcomes. While participants appeared candid and reflective, their statements may not fully capture the complexities or contradictions of actual implementation processes. Third, while the hybrid coding process aimed to balance deductive and inductive insights, the final analytical categories were shaped by the WSA framework, potentially limiting the emergence of unexpected or alternative themes. Relatedly, two WSA dimensions—"Pedagogy and Learning" and "Capacity Building and Professional Development"—were not retained as standalone categories due to insufficient depth in the data. This may reflect a true absence in practice, but it could also be a result of interview design or analytic prioritization. Finally, although the analysis focused on school leaders, ESD is inherently a multi-actor process involving teachers, students, parents, and external stakeholders. Future research should triangulate leadership perspectives with those of other actors to better understand the relational dynamics that shape sustainability-oriented school development.

6 Conclusion

This study explored how school leaders in Baden-Württemberg perceive and enact their role in the holistic implementation of ESD. By analyzing their narratives through the lens of the WSA, it sheds light on the conceptual ambiguities, structural constraints, and leadership practices that shape sustainability-oriented school development in the German context.

The findings demonstrate that while most school leaders are open to sustainability and recognize its importance, ESD is rarely embedded as a comprehensive and strategic agenda. Instead, it is often framed as a set of isolated projects, hindered by systemic challenges such as resource shortages, curricular rigidity, and the absence of a shared vision. A notable contribution of this study lies in its nuanced documentation of leadership as more than a formal role—as a continuous balancing act between motivation, delegation, and constraint navigation. Leadership practices varied widely across the sample: while some leaders displayed strong ownership and strategic orientation, many acted as buffers between policy demands and everyday realities, operating within the limits of institutional structures.

This research contributes to the growing field of ESD leadership by offering empirically grounded insights into the tension between individual commitment and systemic limitation. It highlights the need for clearer policy alignment, professional development opportunities, and institutional support mechanisms to empower school leaders as agents of whole-school transformation. Further research should expand on this work by including perspectives from teachers, students, and parents, and by examining how leadership practices evolve over time in response to structural reforms and pedagogical innovation. Ultimately, the transition toward sustainable schools requires not only policy ambition but also a deep understanding of the lived realities and capacities of those leading the change.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Ethics Committee of Karlsruhe Institute of Technology (KIT). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

OW: Project administration, Validation, Writing – review & editing, Supervision, Writing – original draft, Methodology, Data curation, Software, Visualization, Investigation, Conceptualization. LS: Writing – original draft, Conceptualization, Validation, Writing – review & editing, Investigation, Formal analysis. IW:

Writing – original draft, Writing – review & editing, Funding acquisition, Supervision.

Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that Generative AI was used in the creation of this manuscript. Generative AI (OpenAI's ChatGPT) was used to support the drafting, editing, and formatting of sections of the article, including the refinement of academic language, generation of summaries and tables based on coded interview data, and preparation of Supplementary materials (e.g., abstract, visual models, and appendix content). All content was critically reviewed, verified, and edited by the author(s) to ensure accuracy, originality, and alignment with the research data and objectives.

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Supplementary material

The Supplemntary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2025.1693308/full#supplementary-material

References

Albers, F. (2022). "Transformative bildung für nachhaltige Entwicklung in der Schule. [transformative education for sustainable development in schools.]" in Transformative bildung durch Hochschulen [transformative education in higher education]. eds. A. Krainer, M. Singer-Brodowski and U. Overwien (Wiesbaden: Springer VS), 83–99.

Borg, F., Winberg, M., Gericke, N. M., and Borg, J. (2025). Principals' views and reported actions on sustainability from a whole school approach perspective: a comparative study of eco- and non-eco-certified preschools in Sweden. *Environ. Educ. Res.* 31, 897–919. doi: 10.1080/13504622.2025.2465716

Braun, V., and Clarke, V. (2006). Using thematic analysis in psychology. *Qual. Res. Psychol.* 3, 77–101. doi: 10.1191/1478088706qp063oa

Braun, V., and Clarke, V. (2023). Toward good practice in thematic analysis: avoiding common problems and be(com)ing a knowing researcher. *Int. J. Transgender Health* 24, 1–6. doi: 10.1080/26895269.2022.2129597

Christ, J., and Sommer, C. (2023). "Nachhaltigkeit und Schulentwicklung: Bedingungen und Gelingensfaktoren [Sustainability and School Development:

Conditions and Success Factors]" in Bildung für nachhaltige Entwicklung in Schulen [Education for Sustainable Development in Schools]. eds. A. Wenzel and M. Grundwald (Wiesbaden: Springer VS), 37–56.

Denzin, N. K., and Lincoln, Y. S. (2018). The SAGE handbook of qualitative research. 5th Edn. Thousand Oaks, CA: SAGE Publications.

Forssten Seiser, A., Mogren, A., Gericke, N. M., Berglund, T., and Olsson, D. (2022). Developing school leading guidelines facilitating a whole school approach to education for sustainable development. *Environ. Educ. Res.* 29, 783–805. doi: 10.1080/13504622.2022.2151980

Gericke, N. M. (2022). "Implementation of education for sustainable development through a whole school approach" in Education for sustainable development in primary and secondary schools. ed. G. Karaarslan-Semiz (Cham: Springer), 153–168.

Gericke, N., Forssten Seiser, A., Mogren, A., Berglund, T., and Olsson, D. (2024). "How to institutionalize a whole school approach to education for sustainable development" in Whole school approaches to sustainability. eds. A. E. J. Walset al. (Cham: Springer), 57–70.

Gericke, N., and Torbjörnsson, T. (2022). Supporting local school reform toward education for sustainable development: the need for creating and continuously negotiating a shared vision and building trust. *J. Environ. Educ.* 53, 231–249. doi: 10.1080/00958964.2022.2102565

Holst, J. (2023). Towards coherence on sustainability in education: a systematic review of whole institution approaches. *Sustain. Sci.* 18, 1015–1030. doi: 10.1007/s11625-022-01226-8

Huber, S. G. (2019). "Führung und Management von Schulen: Anforderungen, Aufgaben und Kompetenzen von Schulleitung [Leadership and Management of Schools: Requirements, Tasks, and Competencies of School Leadership]" in Lehrerprofessionalität und Schulqualität [teacher professionalism and school quality]. eds. U. Steffens and P. Posch (Münster: Waxmann), 373–393.

Leo, U., and Wickenberg, P. (2013). Professional norms in school leadership: change efforts in implementation of education for sustainable development. *J. Educ. Change* 14, 403–422. doi: 10.1007/s10833-013-9207-8

Mathie, R. G. (2024). "A whole school approach: a synthesis of interconnected policy, practice, and research Conceptualisations" in Whole school approaches to sustainability. eds. A. E. Wals, B. Bjønness, A. Sinnes and I. Eikeland (Cham: Springer), 9–33.

Mogren, A., and Gericke, N. (2019). School leaders' experiences of implementing education for sustainable development—anchoring the transformative perspective. *Sustainability* 11:3343. doi: 10.3390/su11123343

Müller, U., Hancock, D. R., Stricker, T., and Wang, C. (2021). Implementing ESD in schools: perspectives of principals in Germany, Macau, and the USA. *Sustainability* 13:9823. doi: 10.3390/su13179823

Ralebese, M. D., Jita, L. C., and Badmus, O. T. (2025) Perceptions and practices of principals: examining instructional leadership for curriculum reform. *Front. Educ.* 10:1591106. doi: 10.3389/feduc.2025.1591106

Rieckmann, M. (2021). "Bildung für nachhaltige Entwicklung: perspektiven und herausforderungen für das deutsche Bildungssystem [education for sustainable development: perspectives and challenges for the German education system]" in Transformative Bildung in der praxis [transformative education in practice]. eds. F. Heinrichs, K. Fischer and U. Overwien (München: oekom), 19–34.

Singer-Brodowski, M., and Kminek, G. (2023). Von BNE 1 und BNE 2 zur integrativen BNE: Entwicklungsperspektiven für schulische Bildung für nachhaltige Entwicklung. [from ESD 1 and ESD 2 to integrative ESD: development perspectives for school-based education for sustainable development]. *Z. Int. Bildungsforsch. Entwicklungs Paedagog.* 46, 13–19. doi: 10.31244/dds.2023.02.03

Stricker, T., Müller, U., Hancock, D. R., and Wang, C. (2023). Schulleiterinnen als Promotorinnen der Bildung für nachhaltige Entwicklung. Bericht zum Forschungsprojekt [school principals as promoters of education for sustainable development. Report on the research project] "Lead4ESD principal study". *Dtsch. Schule* 115, 142–146. doi: 10.25656/01:26988

UNESCO (2017). Education for sustainable development goals: learning objectives. Paris: United Nations Educational, Scientific and Cultural Organization.

UNESCO (2020). Education for sustainable development—a roadmap. Paris: United Nations Educational, Scientific and Cultural Organization.

United Nations 2023 Goal 4—Quality Education. Available on at: https://www.un.org/sustainabledevelopment/education/ (Accessed August 6, 2025).

Vare, P., and Scott, W. (2007). Learning for a change: exploring the relationship between education and sustainable development. *J. Educ. Sustain. Dev.* 1, 191–198. doi: 10.1177/097340820700100209

Verhelst, D., Vanhoof, J., and Van Petegem, P. (2021). School effectiveness for education for sustainable development (ESD): what characterizes an ESD-effective school organization? *Educ. Manag. Adm. Leadersh.* 51, 502–525. doi: 10.1177/1741143220985196

Wals, A. E. J., and Mathie, R. G. (2022). "Whole school responses to climate urgency and related sustainability challenges" in Encyclopedia of educational innovation. eds. M. A. Peters and R. Heraud (Singapore: Springer), 1–8.

Wals, A. E. J., and Mathie, R. G. (2024). "It takes a whole school: an introduction" in Whole school approaches to sustainability. ed. A. E. J. Wals (Cham: Springer), 1–8.

Wohlfart, O., Reimers, K., and Wagner, I. (2026). Navigating complexity: school leadership as part of school development in Germany. *JERO - Journal for educational research online.*

Zachariou, A., and Kadji-Beltran, C. (2009). Cypriot primary school principals' understanding of education for sustainable development key terms and their opinions about factors affecting its implementation. *Environ. Educ. Res.* 15, 315–342. doi: 10.1080/13504620902862902