

 Research Article

Interdisciplinary Integration of Sustainable Development Goals in Secondary Education

Rena Alasgarova¹ , Eltaj Maharramova¹ 

¹The Modern Educational Complex Named in Honour of Heydar Aliyev, Baku, Azerbaijan

Abstract

This qualitative study examines the role of teacher collaboration in integrating the Sustainable Development Goals (SDGs) into interdisciplinary secondary education in Azerbaijan. A total of 157 educators and school leaders from 20 schools participated in in-depth interviews, providing insights into their knowledge of SDGs, collaboration practices, and perceived institutional support. The study identifies that while educators demonstrate a general awareness of the importance of sustainability, their initial understanding of the SDGs is often vague or incomplete. Once clarified, participants recognized that many of their existing practices already align with SDG competencies, albeit unintentionally. The findings highlight several critical barriers to effective SDG collaboration, including heavy emphasis on exam-driven instruction, limited practical training, inconsistent communication, and scarcity of instructional resources aligned with local language and classroom needs. The Ministry of Education's requirement for schools to prepare sustainability-themed action plans has increased visibility of SDG-related initiatives; however, teacher engagement in planning and interdisciplinary collaboration remains limited due to administrative centralization of responsibilities. The study proposes a comprehensive teacher development framework emphasizing SDG literacy enhancement, structured collaboration, and interdisciplinary pedagogical innovation. Practical implications include the need for systematic professional development, distributed leadership models, and deeper community participation in sustainability initiatives. The findings further contribute to theoretical perspectives on sustainable education by highlighting how shared vision and institutional support facilitate interdisciplinary teaching practices. This research advances understanding of the contextual challenges and opportunities for SDG education in post-Soviet educational systems and underscores the importance of empowering teachers as proactive change agents in promoting sustainability across the curriculum.

Keywords: Interdisciplinary Curriculum, Professional Development for Sustainability, Secondary Education, Teacher Development, Teacher Training

✉ Correspondence
Rena Alasgarova
ralasgarova@ada.edu.az

Received
October 25, 2025

Accepted
December 21, 2025

Published
June 1, 2026

Citation: Alasgarova, R., & Maharramova, E. (2026). Interdisciplinary integration of sustainable development goals in secondary education. *Journal of Education for Sustainable Development Studies*, 3(1), 101–112.

DOI: [10.70232/jesds.v3i1.58](https://doi.org/10.70232/jesds.v3i1.58)

© 2026 The Author(s).
Published by
Scientia Publica Media



This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial License.

1. INTRODUCTION

More than ever, education plays a crucial role in equipping the next generation with the skills necessary to manage and confront the complex global challenges that are rapidly shaping our world. The ability of today's students to contribute to sustainable solutions is crucial since they will be tomorrow's leaders. To prepare students to be proactive change agents in a sustainable future, it is imperative that teachers collaborate in order to integrate the Sustainable Development Goals (SDGs) into secondary education.

Schools have a pivotal role in shaping the minds and hearts of future citizens by imparting not only academic information but also global awareness and ethical responsibility. A calculated step to provide pupils with a thorough awareness of and dedication to solving global issues is the inclusion of the SDGs in

school curricula (Fullan & Hargreaves, 2016). It is about getting the younger generation ready to behave with compassion, think critically, and take an active role in creating a sustainable future.

Instructors' cooperative efforts are at the heart of this educational revolution. When educators from different fields collaborate to incorporate the SDGs' concepts into their instruction, they offer a comprehensive, multidimensional educational experience. An interdisciplinary approach is essential for students to understand the interconnection of global concerns and develop the creative thinking required for multiple solutions (Vangrieken et al., 2015). A common understanding among teachers of the importance of the SDGs can greatly increase the effectiveness of this teaching strategy. A dynamic and motivating learning environment can be created by instructors who share a commitment to sustainability, allowing sustainability to be actively implemented and valued in the classroom (Leithwood et al., 2019).

Another important component in this equation is administrative assistance, which serves as a catalyst for facilitating teacher cooperation and the successful integration of the SDGs. When it comes to providing the tools, encouragement, and institutional culture that prioritize and promote sustainability education, school leaders are essential (Leithwood et al., 2019). Their support is crucial for creating an atmosphere where educators feel encouraged and empowered to experiment and work together to improve their methods.

The purpose of this study is to examine how these kinds of cooperative learning approaches might equip students with the skills necessary to interact with and resolve the most important current issues. Gaining insight into the dynamics of teacher collaboration, which are supported by shared sustainability commitment and supportive leadership, can be very beneficial in improving the integration of SDGs in the classroom.

This research employed a qualitative methodology to delve into the dynamics of teacher collaboration in the integration of SDGs into the interdisciplinary curriculum. A total of 157 teachers, along with leaders and managers from 20 secondary schools across Azerbaijan, participated in in-depth interviews. The qualitative approach allowed for a rich, detailed exploration of the participants' perspectives, enabling the study to capture the complexities and subtleties of teacher collaboration and interdisciplinary learning in the context of SDG education.

The findings from these interviews revealed significant insights into the challenges and opportunities faced by educators in incorporating the SDGs into their teaching practices. The data underscored the need for a supportive institutional framework, effective communication, and shared commitment to sustainability goals among educators. Based on these findings, the research proposes a comprehensive training program tailored for teachers and school leaders. This program aims to enhance their understanding of the SDGs, foster effective collaboration skills, and equip them with innovative pedagogical strategies. We design the training not only to address the identified gaps but also to leverage the strengths observed in the current practices of educators in Azerbaijan, ensuring a robust and contextualized approach to fostering sustainable education through collaborative efforts.

2. LITERATURE REVIEW

2.1. The Whole School Approach

The Whole-School Approach (WSA) views sustainability not as an isolated subject, but as something that should permeate all dimensions of schooling, including curriculum, pedagogy, campus operations, leadership, and community partnerships (e.g., Henderson & Tilbury, 2004; Katikas & Sotiriou, 2024). This approach aligns with the broader perspective that sustainable education requires systemic change within educational institutions, influencing policies, physical operations, and community relationships alongside teaching and learning.

Recent policy documents and empirical studies reinforce this systemic view. For example, the European Commission's input paper on learning for environmental sustainability defines a WSA as embedding sustainability across the institution, including governance, teaching, campus, and community links, rather than confining it to individual projects (Tilbury & Galvin, 2022).

Effective implementation of WSA entails integrating sustainability into various domains: the curriculum, teaching and learning practices, school governance, the school's physical and social environment, and community partnerships (Tilbury & Galvin, 2022). It calls for a participatory process where all school stakeholders are involved in co-creating and sustaining a shared vision for environmental sustainability (Scott & Gough, 2003).

The curriculum is a key component of the whole-school approach, as sustainability should be integrated across subjects rather than treated as a separate topic. This supports interdisciplinary learning and helps students engage critically with complex social, environmental, and economic issues (McKeown & Hopkins, 2003). The approach also values experiential and place-based learning, where students connect sustainability to their own communities through practical activities and real-world contexts (Sobel, 2004). Although implementation can require teacher professional development, changes in school governance, and additional resources, whole-school approaches can strengthen students' sense of agency and responsibility for contributing to a more sustainable future.

Holst et al. (2025) show, in a large mixed-methods study with principals in Germany, that although 80% of school leaders would like sustainability to become a core feature of school education, most describe current practice as fragmented or add-on. They identify lack of time, resources, and structural integration as key barriers to whole-school sustainability, and call for stronger alignment of policy, quality standards, and professional development. Case studies and reports on WSA further stress that supportive national frameworks and local community partnerships are critical for sustaining change over time (Wals & Mathie, 2022).

WSA is a dynamic and holistic framework for embedding environmental sustainability in education. By encompassing various aspects of school life, it not only educates students about sustainability but also transforms schools into models of sustainable practice, thereby playing a crucial role in the broader transition to a sustainable society.

2.2. The Role of Teacher Collaboration in Educational Success

The role of teacher collaboration in educational success is well-documented and vital to effective schooling. Research has consistently demonstrated that when teachers work together, they create a culture of shared responsibility that leads to improved teaching practices, professional growth, and, most importantly, enhanced student outcomes (Darling-Hammond et al., 2017; Vangrieken et al., 2015). Collaboration among educators fosters a professional learning community where continuous improvement, collective problem-solving, and innovation in teaching are the norms rather than the exceptions (DuFour, 2004). In the field of sustainability and climate change education, recent work has examined how structured collaboration can address teachers' uncertainty and limited preparation. De Rivas et al. (2025), for instance, analyze a researcher-teacher collaborative intervention in secondary schools and show that joint planning and reflection help teachers move from fragmented, content-heavy lessons towards a more inquiry-based and action-oriented climate education.

Teacher collaboration can manifest in various forms, including joint lesson planning, shared resource development, co-teaching strategies, and peer observations. These collaborative practices enable teachers to leverage each other's strengths, share challenges, and develop collective strategies to address students' needs. The synergy created through such collaboration not only enriches the teaching experience but also significantly impacts student learning, as it fosters a more supportive and cohesive learning environment (Ronfeldt et al., 2015).

However, teacher collaboration's success is not solely dependent on individual teachers' willingness and efforts. The role of school administration is crucial in creating an environment that supports and promotes collaborative practices. School leaders play a pivotal role in setting the tone for collaboration and providing the necessary time, resources, and support systems to facilitate effective teamwork among teachers (Leithwood et al., 2019).

Administrative support for collaboration can include scheduling common planning time, offering professional development opportunities, and creating structures that allow teachers to work together

consistently (Schleifer et al., 2017). Effective school administrators understand that fostering teacher collaboration is an investment in the school's educational quality. They know that when teachers collaborate, they engage in a deeper level of professional dialogue and inquiry, leading to more thoughtful and innovative approaches to teaching and learning. This, in turn, leads to a school culture that values continuous learning, adaptability, and a shared commitment to student success.

UNESCO and the Global Teacher Task Force further argue that teaching should be understood as a collaborative profession, and that structural conditions (time, leadership support, recognition) are needed to make collaboration a routine part of teachers' work (Organization for Economic Co-operation and Development, 2020). Teacher collaboration is a cornerstone of effective educational practice, with a significant impact on teacher development and student outcomes. The support and facilitation provided by school administration are critical to nurturing a culture of collaboration. By prioritizing and fostering collaborative practices, school leaders can enhance the overall effectiveness of their schools, leading to a more dynamic, supportive, and successful educational environment.

2.3. Teacher Training for Sustainable Development

The evolving landscape of education necessitates a paradigm shift in teacher training, particularly in the context of sustainable development. Mulà et al. (2017) advocate for shifting the focus of teacher education towards organizational learning to foster a culture of sustainability within educational institutions. This approach contrasts with the traditional method, which often isolates sustainability education within social and environmental studies. Ferreira et al. (2019) further critique the prevalent practice of confining sustainability to specific subjects rather than promoting an interdisciplinary and WSA approach.

Understanding the teacher education system necessitates recognizing the diverse agencies and stakeholders involved across various EU Member States. Despite variations, commonalities exist that allow for systemic mapping to aid policymakers in addressing stakeholders' needs, identifying influential gatekeepers, and pinpointing catalytic entry points that can have widespread effects within the system (Malhotra & Amor, 2023).

There is a significant gap in initial teacher training, where courses related to educational leadership, psychology, or sociology seldom incorporate sustainability, thereby missing opportunities for school-wide implementation (Tilbury & Galvin, 2022). According to Anđić and Vorkapić (2014), while CPD programs might emphasize the importance of linking sustainability across different subjects, they often lack practical guidance on executing an interdisciplinary approach and fostering effective collaboration and teamwork within schools.

Malhotra and Amor (2023) suggest that policies regarding education for sustainability should be dynamic, encouraging continuous learning and adaptation. Kioupi and Voulvoulis (2019) note the absence of governmental assessment frameworks to evaluate effective sustainability education practices, leaving schools and teachers without clear guidance. External tools like 'Green Flag' or 'Jump into Sustainable Lifestyle self-assessment tool' try to fill this gap, but their focus is more on school-level progress than classroom-level support for assessing sustainability competencies (Parry & Metzger, 2023).

Cebrián et al. (2020) and Mulà et al. (2017) emphasize the importance of accurately assessing learners' sustainability competences to ensure that education is impactful and not merely superficial. Wiek et al. (2011) also advocate for alternative assessment methods that can effectively measure outcomes related to sustainability, including emotional and agency aspects, within an interdisciplinary learning context.

The review of the research studies pinpoints the necessity of transforming teacher training for sustainable development into a more integrated, interdisciplinary, and organization-wide endeavor. This shift requires a holistic view of education, where sustainability is woven into the fabric of the school culture, necessitating systemic changes, supportive policies, and innovative assessment frameworks to truly equip teachers and students for the challenges of sustainable development. Hence, the research is guided by the following research questions:

RQ1: What are the existing factors that positively or negatively influence teacher collaboration for SDG integration across disciplines?

RQ2: To what extent does a shared vision among teachers positively influence the success of SDG integration across disciplines?

RQ3: How does administrative support contribute to or hinder teacher collaboration for SDG integration?

3. METHODS

3.1. Study Design

This research aims to systematically explore the dynamics of teacher collaboration in integrating SDGs into interdisciplinary curricula within secondary education. The objectives include identifying and evaluating the factors that influence teacher collaboration for SDG integration, determining the impact of a shared vision among educators on the success of this integration, and exploring the role of administrative support in facilitating or impeding such collaborative efforts. Guided by the research questions, the study employs a qualitative research approach and thematic analysis, which allows for capturing the nuanced perspectives and experiences of educators involved in SDG integration. Qualitative methods allow for in-depth exploration of the complex interactions and processes that underlie effective collaboration in educational settings (Creswell & Poth, 2017). Furthermore, thematic analysis serves as the methodological framework for data analysis, providing a systematic approach to identifying, analyzing, and reporting patterns within the data (Braun & Clarke, 2006).

3.2. Population

The study involved 157 participants, including teachers, principals, and deputy principals from 20 secondary schools in Azerbaijan. The sample consisted of 138 female educators and 19 male educators, reflecting the national gender distribution in the teaching profession. Participants represented a wide range of teaching experience from early-career (1–5 years) to highly experienced educators (up to 30 years). This diversity ensured that perspectives were captured across different career stages and leadership roles. The approval facilitated the inclusion of a varied group of educators, thereby enhancing the representativeness of the sample and the validity of the study (Creswell & Creswell, 2022).

Utilizing convenience sampling, the research aimed to include a mix of participants, principals, deputy principals, and teachers from various disciplines, genders, and teaching tenures, to enrich the depth and breadth of the study (Etikan et al., 2015). While convenience sampling facilitated the inclusion of participants who met specific criteria, it is essential to acknowledge its limitations, such as potential bias and lack of generalizability to all educational contexts (Etikan et al., 2015). Each participant provided informed consent, thoroughly understanding the research objectives and ensuring their voluntary and confidential involvement, adhering to the ethical standards established by the American Psychological Association (APA, 2019). This ethical adherence underscores the study's commitment to maintaining the highest standards of research integrity.

3.3. Data Collection Instruments

The interview instruments used for teachers and school leaders were designed by the research team and validated by experts from the State Agency for Preschool and General Education, which enabled fine-tuning the approach based on their feedback, as is recommended by Creswell and Creswell (2022). Next, a pilot study was conducted with five school leaders and ten teachers to evaluate the clarity, appropriateness, and relevance of the questions. Based on the pilot feedback, several items were refined to improve question alignment with the research objectives. As the instruments consisted solely of open-ended qualitative items, internal consistency measures such as Cronbach's alpha were not applicable.

The survey for school leaders comprised 15 questions, delving into their familiarity with SDGs, their perspectives on teacher collaboration, the factors influencing such collaboration for SDG integration, challenges faced, and the impact of administrative support, among other areas. We designed this

comprehensive set of questions to capture the nuanced views of school leaders on the multifaceted aspects of SDG integration and collaboration in educational settings.

Similarly, the teacher survey, consisting of 12 questions, explored their roles in promoting sustainable development, their experiences with SDG integration, the dynamics of teacher collaboration, and the perceived impact of such collaboration on educational outcomes. By addressing these areas, the survey aimed to gather diverse perspectives from the teaching staff, providing a well-rounded understanding of the subject.

Several strategies were used to ensure the trustworthiness of the qualitative analysis. Two researchers independently coded all transcripts using MAXQDA, and an inter-coder agreement of 0.78 (Cohen’s kappa) was achieved, indicating strong consistency in theme identification and category development. In addition, expert validation of the instruments, participant confirmation of interpretations when needed, and maintenance of an audit trail throughout coding contributed to methodological rigor.

To ensure the accuracy and efficiency of data collection, the interviews were transcribed using a speech-to-text Google AI tool, noted for its convenience and accuracy. Following transcription, the data analysis was conducted using MAXQDA. This analytical process, coupled with re-coding, was crucial to ascertaining the validity of our findings, ensuring that no significant details were overlooked in the analysis (Saldaña, 2021). By employing this method of data collection and analysis, we were able to obtain a thorough and precise understanding of the viewpoints of teachers and school leaders regarding the integration and collaboration of the SDGs.

Table 1. Codebook

Open Codes	Axial Codes	Description
SDG Knowledge Training and Development	Educator Engagement with SDGs	Educators’ understanding and awareness of SDGs. The need and availability of professional development related to SDGs.
Teacher Empowerment		Instances where teachers feel capable and supported in SDG education.
Collaboration Dynamics Vision Alignment	Collaborative Practices and Dynamics	How teachers collaborate on SDG-related projects. Shared vision among educators for SDG education.
Communication Effectiveness Integration Strategies Interdisciplinary Methods Pedagogical Innovation	Teaching and Learning Approaches	Clarity and frequency of SDG-related discussions. Methods to incorporate SDGs into the curriculum. Combining different subjects to teach SDGs. Innovative methods mentioned for SDG education.
Curricular Content Leadership Influence Policy Impact Resource Allocation	Leadership and Institutional Support	Depth of SDG topics covered in the curriculum. Impact of leadership on SDG initiatives. How policies affect SDG initiatives. Resource provision for SDG education.
Student Engagement Assessment Practices Sustainability Outcomes Barrier Identification	Student Engagement and Outcomes Challenges and Barriers	Student interest and involvement with SDGs. Evaluation of student learning on SDGs. Long-term SDG education impacts. Challenges hindering SDG collaboration/integration.
Feedback Mechanisms Cultural Influences Community Involvement	Community and Cultural Influence	Use of feedback to improve SDG teaching. Cultural factors impacting SDG integration. Community role in SDG education.

4. RESULTS

Utilizing a qualitative methodology, this study investigates the experiences and perspectives of 157 teachers and school administrators from 20 schools in Azerbaijan through in-depth interviews. The coding process began with a thorough examination of interview transcripts, from which relevant excerpts were distilled into open codes. These open codes captured the granular details of the participants’ responses, reflecting their experiences, challenges, and perspectives on SDG integration in education. As some teachers responded, “I heard about SDGs before, but I did not understand what they really meant” (T3) or “We are

already doing some SDG activities without calling them SDGs” (T62). The subsequent step involved categorizing these open codes into axial codes, representing broader conceptual categories that encapsulate related ideas and themes. This coding schema was documented in a comprehensive codebook, which delineates the open and axial codes, their descriptions, and exemplary data extracts, providing a structured and transparent overview of the coding process (Table 1).

The majority of respondents initially exhibited a general or vague understanding of the SDGs. However, upon clarification during the interviews, educators acknowledged the significance of integrating SDGs into the curriculum. Interestingly, many educators realized that they were already incorporating SDG-aligned activities into their teaching, albeit without explicit recognition of their connection to the SDGs. This inadvertent alignment with the SDGs underscores a latent potential within the educational community, suggesting that with enhanced awareness and targeted training, SDG integration could become more intentional and effective (Andić & Vorkapić, 2014; Tilbury & Galvin, 2022).

The study revealed that the Ministry of Education mandates schools to develop and submit detailed action plans that encompass themes resonating with the SDGs. While these themes predominantly focus on ecological aspects, they touch upon a broad spectrum of SDGs. The responsibility for crafting and implementing these action plans typically falls on the deputy principals, who then delegate or nominate teachers to execute the corresponding activities. These activities range from environmental initiatives like tree planting and beach clean-ups to social campaigns on gender equality and climate change awareness.

Despite the structured approach to integrating SDG themes, a notable gap emerged: the lack of proactive teacher initiative in championing SDG-related projects. The educators cited time constraints, resource limitations, and an overarching emphasis on exam preparation as significant barriers to active engagement with SDG integration (de Rivas et al., 2025; Kioupi & Voulvoulis, 2019). Furthermore, some educators perceived a lack of support or enthusiasm from key educational stakeholders, including school leadership teams, parents, and the broader school community, which they felt hindered the adoption of a more integrated and collaborative approach to SDG education.

An important observation from the investigation is the subtle interaction between collaborative dynamics and interdisciplinary integration. While there is a general willingness among educators to participate in SDG-related activities, these efforts often occur in silos, lacking a cohesive and interdisciplinary framework. Teachers’ responses confirm this: “Everyone focuses on their own subject. We rarely plan together” (T37); “We talk about SDGs in meetings, but then each teacher returns to their own tasks” (T122). The educators highlighted the need for a shared vision and more practical training to facilitate effective interdisciplinary integration of SDGs, particularly emphasizing the necessity for resources in the language of instruction to make SDG content more accessible.

The thematic map serves as a visual synthesis of the findings of the study, illustrating the interconnectedness of the themes derived from the data (Figure 1). It elucidates the overarching theme of *Empowering Sustainable Futures: Fostering Collaborative and Interdisciplinary Approaches in SDG Education*, highlighting the critical interplay between collaborative empowerment, innovative pedagogical strategies, student-centric outcomes, and the broader institutional and community dynamics that shape SDG education.

One key theme identified is *Student-Centric Outcomes in SDG Education*, which emphasizes the central role of students in the SDG integration process and the consequential impact on their learning and overall development. Within this theme, the notion of student engagement emerges as a critical factor. Educators reported varying levels of student interest and participation in SDG-related content and activities, highlighting how engagement is essential for students to internalize sustainability concepts and develop a sense of responsibility towards sustainable development. Additionally, the theme encompasses the assessment practices employed by educators to evaluate students’ comprehension and application of SDG knowledge. These techniques include more than just evaluating cognitive comprehension; they also involve measuring students’ capacity to apply their knowledge in real-life situations (Kioupi & Voulvoulis, 2019). This allows for a deeper assessment of the efficacy of SDG education.

The theme of *Institutional and Community Dynamics in SDG Education* explores the wider framework in which SDG education takes place. This theme captures how institutional policies, leadership actions, and community interactions influence the integration of SDGs into educational settings. The educators

emphasize that leadership has a great impact on determining the school’s approach to SDG teaching: “Deputy principals assign tasks. Teachers don’t take initiative” (T4) and “We need a shared plan. What we have is instructions from above” (Teacher 10). The actions and attitudes of the leadership significantly influence the success of the project, as emphasized by Leithwood et al. (2019), who argue that school leadership plays a significant role in developing educational projects. Furthermore, the theme explores the impact of external community involvement and cultural elements on the implementation of SDG education. It highlights the interdependence between schools and their broader community in creating a favorable climate for sustainability education. This perspective is consistent with the viewpoints of Henderson and Tilbury (2004), who emphasize the significance of community partnerships in WSA to sustainability, and Kioupi and Voulvoulis (2019), who emphasize the importance of aligning educational outcomes with broader societal and environmental goals.

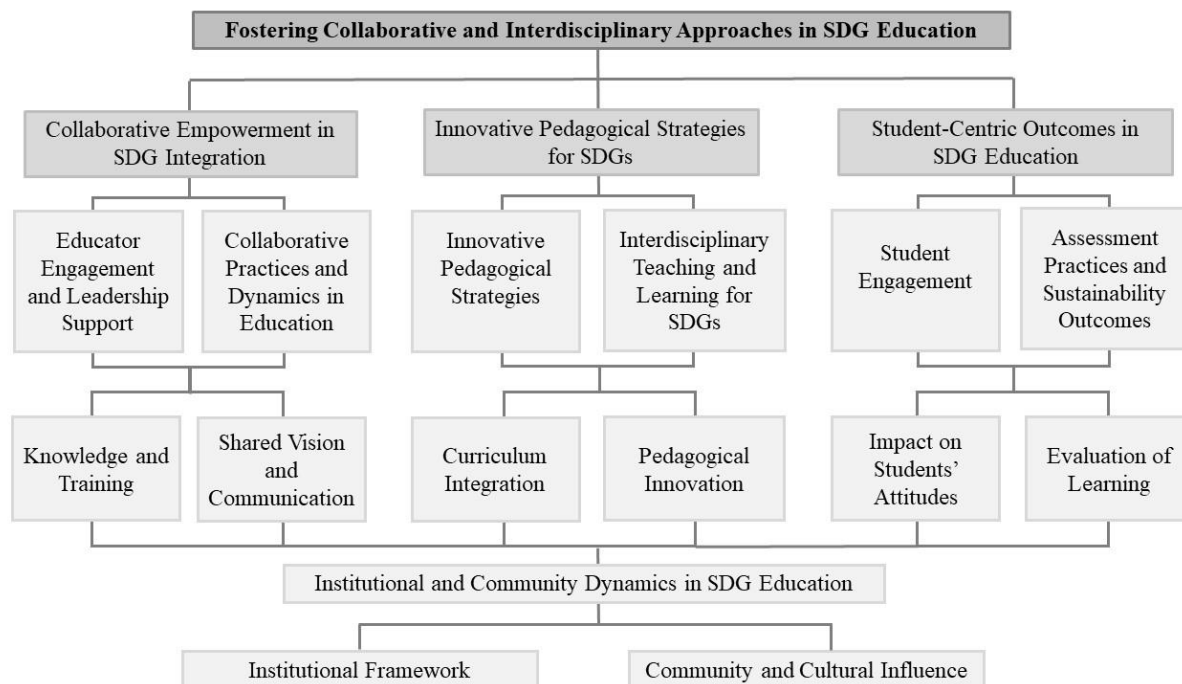


Figure 1. Thematic Map

Through these themes, the study illuminates the complex landscape of SDG integration in education, revealing the multifaceted interactions between educators, students, institutions, and communities. However, for SDG integration to be more meaningful and impactful, a shift towards more intentional, collaborative, and interdisciplinary approaches is essential.

5. DISCUSSION

The study examines the factors that affect teacher collaboration for the integration of SDGs, the importance of a shared vision in this integration, and the influence of administrative support on teacher collaboration. These aspects directly relate to our research questions.

Educators demonstrated a basic or sometimes vague understanding of the SDGs, which, once clarified, was acknowledged as vital for curriculum integration. This aligns with our first research question, highlighting that a foundational factor influencing teacher collaboration for SDG integration is the educators’ understanding of SDGs themselves (Anđić & Vorkapić, 2014; Tilbury & Galvin, 2022; Mulà et al., 2017). The discovery that educators were already aligning their teaching with SDGs, albeit unknowingly, suggests that enhancing SDG awareness could significantly improve deliberate and strategic integration across disciplines, echoing Vangrieken et al. (2015).

Concerning our second research question regarding shared vision, the study illustrates that while educators recognize the importance of SDGs post-clarification, integration efforts often lack a cohesive and unified approach (Organization for Economic Co-operation and Development, 2020). This scenario

underscores the necessity for a shared vision among teachers, which, as Fullan and Hargreaves (2016) advocate, is crucial for meaningful and purposeful inclusion of SDGs in educational practices. A shared vision could catalyze more coherent and collaborative efforts across various disciplines, fostering a more integrated and interdisciplinary approach to SDG education.

Addressing the third research question, the Ministry of Education's directive for schools to formulate detailed action plans resonating with the SDGs reflects a structured approach to SDG integration. However, the execution largely resting on deputy principals might create a bottleneck, potentially stifling broader teacher engagement and collaboration (Holst et al., 2025). This dynamic points to the need for distributed leadership, as advocated by Leithwood et al. (2019), suggesting that enhanced administrative support and a shift towards a more inclusive and collaborative planning process could significantly bolster teacher collaboration for SDG integration.

The identified gaps, such as educators' need for deeper SDG understanding, the absence of a unified vision, and the pivotal role of administrative support, underline the call for a comprehensive teacher development framework. Such a framework, as supported by Darling-Hammond et al. (2017), should not only focus on enriching SDG knowledge but also on nurturing collaborative and interdisciplinary competencies, addressing the core areas highlighted by our research questions. Thus, we propose a framework for teacher development that comprises three core components: enhancing SDG literacy, fostering collaboration and interdisciplinary approaches, and providing practical training and resource provision (Figure 2).

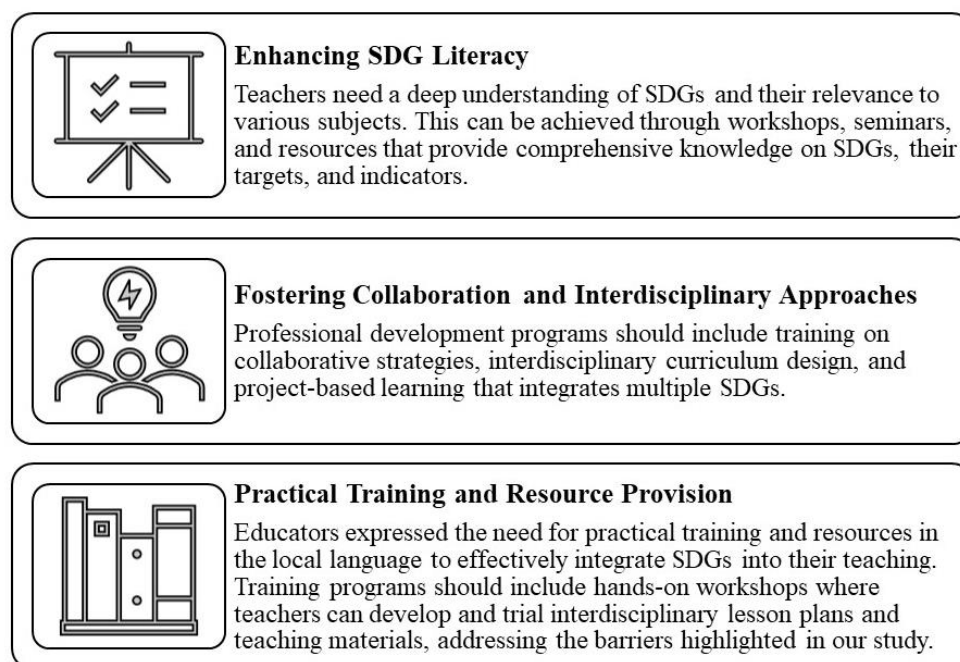


Figure 2. Framework for Teacher Development

The proposed teacher development framework may be adapted to diverse educational contexts by introducing incremental, school-wide structures that build collaborative capacity. For example, schools may designate regular cross-subject planning sessions focused on SDG-aligned competencies, supported by resource banks developed in the local language. Leadership teams can shift from directive task-assignment to facilitation roles, empowering teachers to co-design interdisciplinary projects and reflect collaboratively on their instructional practices. At the policy level, aligning professional development standards and assessment requirements with sustainability competencies would enable systemic embedding of the framework.

Given the insights obtained and the existing theoretical framework on teacher development, we propose a training program structure that encapsulates essential elements to foster SDG integration in education, drawing on principles from WSA and collaborative teaching methodologies.

- **Introductory Workshop on SDGs:** A series of workshops that introduce educators to the concept of SDGs, their importance, and their application across different subjects.
- **Collaborative Teaching Workshops:** Interactive sessions where teachers from various disciplines come together to design interdisciplinary lessons or projects that incorporate SDGs, fostering a shared vision and collaborative dynamics as suggested by our findings.
- **Practical Application and Feedback:** Teachers implement the designed lessons/projects in their classrooms, followed by feedback sessions where they can share experiences, challenges, and successes, facilitating a continuous learning loop.
- **Resource Development:** Sessions dedicated to developing teaching materials and resources in the local language, tailored to the specific needs and contexts of the educators and students.
- **Community Engagement:** Incorporating community involvement in the learning process, reflecting the importance of institutional and community dynamics in SDG education, is highlighted in our analysis.

By integrating the proposed framework and training program with the knowledge gained from our data analysis, our goal is to fill the identified gaps and utilize the untapped potential of educators to effectively integrate the SDGs. This method not only conforms to the existing body of knowledge but also offers a systematic framework for improving teacher cooperation and the integration of SDGs across different subjects, hence promoting sustainable futures through education.

This study advances theoretical understanding of interdisciplinary sustainability education by demonstrating how three interconnected conditions, i.e., shared school vision, structured teacher collaboration, and distributed leadership, mediate the translation of SDG policies into classroom practice. While existing frameworks emphasize the WSA conceptually, this study contributes empirical evidence from a post-Soviet context where collaboration is not a cultural norm, and leadership remains highly centralized. By revealing how teacher agency and collective planning are shaped within hierarchical structures, the findings refine interdisciplinary SDG integration theory and extend ESD scholarship to underrepresented education systems.

6. CONCLUSION AND RECOMMENDATIONS

This research aimed to explore the dynamics of teacher collaboration for the interdisciplinary integration of SDGs in secondary education. Through a qualitative analysis of educators' experiences and insights, we developed a proposed framework for teacher development, addressing the core components essential for enhancing the integration of SDGs into educational practices.

Our findings revealed a fundamental gap in educators' understanding of the SDGs, which, once clarified, was recognized as crucial for curriculum integration. Targeted training and enhanced awareness can harness the significant potential of the inadvertent alignment of existing teaching activities with SDGs (Fullan & Hargreaves, 2016; Vangrieken et al., 2015). The structured approach mandated by the Ministry of Education, while providing a foundation for SDG integration, highlighted the necessity for distributed leadership and increased teacher initiative in the development and execution of action plans (Leithwood et al., 2019).

The proposed framework for teacher development encompasses enhancing SDG literacy, fostering collaboration and interdisciplinary approaches, and providing practical training and resources. The design of this framework equips educators with the necessary knowledge, skills, and resources to effectively integrate SDGs into their teaching, thereby fostering a collaborative, interdisciplinary, and proactive teaching community.

6.1. Limitations

There are certain limitations to this study. The research focused on a specific context, involving teachers and school leaders from 20 schools in Azerbaijan, which may affect the generalizability of the findings. The reliance on self-reported data through interviews could also introduce bias, as participants might present themselves in a more favorable light or misinterpret questions.

6.2. Future Research

Future research should aim to expand the geographical scope of the study to include diverse educational settings, enhancing the generalizability of the findings. Longitudinal studies could provide deeper insights into the evolution of teacher collaboration and SDG integration over time. Additionally, quantitative research could complement this study's qualitative insights, offering a broader perspective on the effectiveness of the proposed teacher development framework.

Investigating the impact of specific training programs and resources developed based on the proposed framework could offer valuable feedback for refining teacher development initiatives. Exploring the role of students in the SDG integration process could also provide a more comprehensive understanding of the educational ecosystem's dynamics.

Acknowledgment. The authors would like to thank all participants who contributed to this study and supported the completion of the research.

Research Ethics. This study was conducted in accordance with APA ethical principles for research involving human participants. Participation was voluntary, informed consent was obtained from all participants, and confidentiality was maintained throughout the research process.

Data Availability Statement. The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest. The authors declare no conflicts of interest related to this research.

Funding. This research received no external funding.

REFERENCES

- American Psychological Association. (2019). *Ethical principles of psychologists and code of conduct*. American Psychological Association. <https://www.apa.org/ethics/code>
- Andić, D., & Vorkapić, S. T. (2014). Interdisciplinary approaches to sustainable development in higher education. In *Handbook of research on pedagogical innovations for sustainable development* (pp. 67–115). IGI Global. <https://doi.org/10.4018/978-1-4666-5856-1.ch005>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- Cebrián, G., Junyent, M., & Mulà, I. (2020). Competencies in education for sustainable development: Emerging teaching and research developments. *Sustainability*, 12(2), Article 579. <https://doi.org/10.3390/su12020579>
- Creswell, J. W., & Creswell, J. D. (2022). *Research design: Qualitative, quantitative and mixed methods approaches* (6th ed.). SAGE.
- Creswell, J. W., & Poth, C. N. (2017). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE.
- Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017, May 31). *Effective teacher professional development*. Learning Policy Institute. <https://eric.ed.gov/?id=ED606743>
- de Rivas, R., Vilches, A., & Mayoral, O. (2025). Bridging the gap: How researcher–teacher collaboration is transforming climate change education in secondary schools. *Sustainability*, 17(3), Article 908. <https://doi.org/10.3390/su17030908>
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2015). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), Article 1. <https://doi.org/10.11648/j.ajtas.20160501.11>
- Ferreira, J.-A., Evans, N., Davis, J. M., & Stevenson, R. (2019). Learning to embed sustainability in teacher education. In *SpringerBriefs in Education*. Springer. <https://doi.org/10.1007/978-981-13-9536-9>
- Fullan, M. & Hargreaves, A. (2016). *Bringing the profession back in: Call to action*. Learning Forward.
- Henderson, K., & Tilbury, D. (2004). *Whole-school approaches to sustainability: An international review of sustainable school programs*. Promise of Place. <https://promiseofplace.org/research-evaluation/research-and-evaluation/whole-school-approaches-to-sustainability-an>

- Holst, J., Brock, A., Grund, J., Schlieszus, A., & Singer-Brodowski, M. (2025). Whole-school sustainability at the core of quality education: Wished for by principals but requiring collective and structural action. *Journal of Cleaner Production*, 519, Article 145897. <https://doi.org/10.1016/j.jclepro.2025.145897>
- Katikas, L., & Sotiriou, S. (2024). Whole school approaches to education for sustainable development. In S. A. McDonagh, A. Caforio, & A. Pollini (Eds.). *The European green deal in education* (185-203). Routledge. <https://doi.org/10.4324/9781003492597-16>
- Kioui, V., & Voulvoulis, N. (2019). Education for Sustainable Development: A systemic framework for connecting the SDGs to educational outcomes. *Sustainability*, 11(21), Article 6104. <https://doi.org/10.3390/su11216104>
- Leithwood, K., Harris, A., & Hopkins, D. (2019). Seven strong claims about successful school leadership revisited. *School Leadership & Management*, 40(1), 5–22. <https://doi.org/10.1080/13632434.2019.1596077>
- Malhotra, N., & Amor, Y. B. (2023). Building cross-sectoral education programs for sustainable development. *Rethinking Education for Sustainable Development*, 89–101. <https://doi.org/10.5040/9781350256156.0014>
- McKeown, R., & Hopkins, C. (2003). EE ≠ ESD: Defusing the worry. *Environmental Education Research*, 9(1), 117–128. <https://doi.org/10.1080/13504620303469>
- Mulà, I., Tilbury, D., Ryan, A., Mader, M., Dlouhá, J., Mader, C., Benayas, J., Dlouhý, J., & Alba, D. (2017). Catalysing change in higher education for sustainable development. *International Journal of Sustainability in Higher Education*, 18(5), 798–820. <https://doi.org/10.1108/ijsh-03-2017-0043>
- Organization for Economic Co-operation and Development. (2020). *Professional collaboration as a key support for teachers working in challenging environments*. OECD. https://www.oecd.org/en/publications/2020/09/professional-collaboration-as-a-key-support-for-teachers-working-in-challenging-environments_310402b3.html
- Parry, S., & Metzger, E. (2023). Barriers to learning for sustainability: A teacher perspective. *Sustainable Earth Reviews*, 6(1). <https://doi.org/10.1186/s42055-022-00050-3>
- Ronfeldt, M., Farmer, S. O., McQueen, K., & Grissom, J. A. (2015). Teacher collaboration in instructional teams and student achievement. *American Educational Research Journal*, 52(3), 475–514. <https://doi.org/10.3102/0002831215585562>
- Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). SAGE.
- Schleifer, D., Rinehart, C., & Yanisch, T. (2017). *Teacher collaboration in perspective: A guide to research*. Public Agenda.
- Scott, W., & Gough, S. (2004). *Sustainable development and learning: Framing the issues*. Routledge.
- Sobel, D. (2004). *Place-based education: Connecting classrooms and communities*. Orion Society.
- Tilbury, D., & Galvin, C. (2022, January). *Input paper: A whole school approach to learning for environmental sustainability*. European Commission. Retrieved from <https://education.ec.europa.eu/document/input-paper-a-whole-school-approach-to-learning-for-environmental-sustainability>
- Vangrieken, K., Dochy, F., Raes, E., & Kyndt, E. (2015). Teacher collaboration: A systematic review. *Educational Research Review*, 15, 17–40. <https://doi.org/10.1016/j.edurev.2015.04.002>
- Wals, A. E. J., & Mathie, R. G. (2022). Whole school approaches to sustainability – critical case studies from Europe. In *Education for sustainable development in Asia and Europe*. https://www.kas.de/documents/288143/21897256/Panorama_2022_02_ESD_v5e_Wals_Mathie.pdf/316d1fd3-b340-3478-f39c-1cba356810ca?t=1671430415108
- Wiek, A., Withycombe, L., & Redman, C. L. (2011). Key competencies in sustainability: A reference framework for academic program development. *Sustainability Science*, 6(2), 203–218. <https://doi.org/10.1007/s11625-011-0132-6>