

Core elements and Practical Strategies for Building Teacher Capacity in Sustainable Education System

Lanting Yu*, Amy Liew Xiu Jie

UNITAR International University, Faculty of Education and Humanities, Petaling Jaya, Selangor, 47301, Malaysia

**Corresponding author: Lanting Yu, mc250133059@student.unitar.my*

Copyright: 2025 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY-NC 4.0), permitting distribution and reproduction in any medium, provided the original author and source are credited, and explicitly prohibiting its use for commercial purposes.

Abstract: As the key promoter of education for sustainable development (ESD), the capacity building of teachers has attracted much attention. UNESCO emphasizes that teachers need to have the ability to integrate ESD concepts into teaching practice, but there is currently insufficient research on using UNESCO sites to promote teacher capacity building. This study explored the core elements and strategies for teacher capacity building by observing teaching activities at 10 universities in China, interviewing 30 lecturers or experts. The study found that the core elements of teacher capacity building mainly include a deep understanding of ESD concepts, the ability to combine with lifelong learning, and the ability to integrate into teaching practice. UNESCO sites can enhance teachers' sustainable awareness and practical ability and promote knowledge sharing through environmental training, field trips, and interactive teaching. Therefore, this study calls on decision-makers and educational institutions to provide policy and resource support, encourage teachers to participate in UNESCO heritage activities, and strengthen cooperation between UNESCO heritage sites and educational institutions.

Keywords: Sustainable Education System; Teachers Capacity; Core Elements; Practical Strategies

Published: Sept 14, 2025

DOI: <https://doi.org/10.62177/jetp.v2i3.641>

1.Introduction

In the continuous evolution of the global education system, Education for Sustainable Development (ESD) has gradually occupied an important position and become a key force in promoting the sustainable development of society. As an advanced educational concept, ESD aims to develop learners' knowledge, skills, attitudes and values to cope with the challenges of environmental, social and economic sustainability, so that they can actively participate in and contribute to the development of society in a sustainable direction (Malik, et al., 2023).

Teachers, as the direct implementers of educational activities, play an irreplaceable key role in sustainable education. They are not only disseminators of knowledge, but also practitioners and guides of the concept of sustainable development. Teachers need to integrate the concept of sustainable development into all aspects of daily teaching and learning, and through innovative teaching methods and rich teaching content, stimulate students' concern and thinking about sustainable development issues, and cultivate students' awareness and ability of sustainable development.

However, the current teacher capacity building is facing many serious challenges in the context of sustainable education. On the one hand, some teachers do not have a deep enough understanding of the concepts and connotations of sustainable education, and fail to fully grasp its core elements and objectives, which makes it difficult for them to accurately and

systematically convey the concept of sustainable development to students during the teaching process, and unable to guide students to think deeply about the issue of sustainable development. On the other hand, the lack of ability to integrate the concept of sustainable education into teaching practice is also a prominent problem. Although many teachers realize the importance of sustainable education, they lack effective teaching strategies and methods in actual teaching, making it difficult for them to transform abstract concepts of sustainable development into vivid and concrete teaching contents, and failing to stimulate students' interest and enthusiasm in learning. In addition, teachers also face challenges in lifelong learning. With the continuous updating of knowledge and concepts in the field of sustainable development, teachers need to continuously learn and improve their abilities to meet the needs of the development of sustainable education, but at present, some teachers lack the awareness and motivation of lifelong learning, making it difficult for them to keep up with the pace of the times. Enhancing teachers' competence can promote the improvement of the quality of education and teaching, promote the in-depth implementation and realization of the concept of sustainable education in school education, and lay a solid foundation for the sustainable development of education.

2. Methodology

2.1 Sample

The study selected 10 universities in China as samples, covering different regions, types, and levels of higher education institutions, including 4 in the eastern region, 3 in the central region, and 3 in the western region, balancing economically developed and underdeveloped areas; It also includes 5 comprehensive universities, 3 teacher training institutions, and 2 science and engineering universities, covering core ESD-related disciplines such as environmental science, education, and interdisciplinary fields like sustainable design and green economy. The study prioritized 6 universities that had participated in provincial-level or higher ESD pilot projects, while also including 4 non-pilot universities as controls.

Table 1: Classification of Sample Universities

Classification dimension	Classification dimension	Classification dimension
Regional Distribution	Eastern	4
	Central	3
	Western	3
Type of Institution	Comprehensive universities	5
	Teacher training colleges	3
	Science and engineering colleges	2
Participation in ESD Pilot Projects	Participated in provincial-level higher ESD pilot projects	6
	Non-pilot universities	4

2.2 Data Collection

In terms of teaching experience, there are 8 teachers with less than 5 years of experience, 12 with 5–10 years, and 10 with over 10 years; by academic discipline, the breakdown is as follows: 6 in environmental science, 7 in education, 5 in economics, 4 in engineering and technology, and 8 in humanities and social sciences; In terms of ESD experience, 18 teachers have explicit ESD teaching practice experience, while 12 teachers have no systematic practice but are interested in ESD. There are 3 higher education policy researchers, 2 UNESCO ESD project officers, and 3 primary and secondary school ESD researchers, and the average years of experience for this group are all over 10 years.

Table 2: Statistics on the backgrounds of teachers and experts

Classification Dimensions	Specific Content	Number
Years of Teaching Experience	Less than 5 years	8
	5-10 years	12
	More than 10 years	10
Subject Area	Environmental Science	6
	Education	7
	Economics	5
	Engineering Technology	4
	Humanities and Social Sciences	8
ESD Experience	Those with clear ESD teaching experience	18
	Those without systematic experience but with interest	12
Occupational Type	Higher education policy researchers	3
	UNESCO ESD project officers	2
	Primary and secondary school ESD teaching and research staff	3

Through observations of teaching activities at these universities, we gained a deeper understanding of how teachers integrate sustainable education concepts into their classroom teaching, including the selection of teaching content, the application of teaching methods, and the organization of teaching activities. During the observation process, we recorded teachers' teaching behaviors and students' reactions in detail and collected relevant teaching materials and data. To gain a deeper understanding of teachers' perceptions and practical experiences regarding sustainable education, this study conducted interviews with 30 lecturers or experts. The interviewees included teachers from various disciplinary fields who possess extensive teaching and research experience in sustainable education. During the interviews, a semi-structured interview approach was adopted, focusing on teachers' understanding of sustainable education, the challenges and issues encountered in teaching, and their views on utilizing UNESCO heritage sites to enhance teachers' professional development. Through in-depth interviews, the study obtained teachers' genuine perspectives and valuable experiences, providing rich qualitative data for the research.

2.3 Tool

Using thematic analysis, the research data obtained (including teaching observation data from 10 universities and interview data from 30 lecturers and experts) was coded using NVivo 11.0 Plus software. During the open coding phase, each text was read and analyzed word by word, followed by free coding to establish free nodes. A total of 175 free nodes were obtained during this phase. In the axial coding phase, the free nodes were recoded by identifying similarities among nodes of the same type, clarifying relationships between nodes, and forming a tree-like coding structure. This phase yielded 40 thematic concepts (covering areas such as ESD concept understanding, teacher competency elements, and the role of UNESCO heritage sites). In the selective coding phase, we focused on analyzing the established conceptual categories based on the tree-like coding structure, concentrating on overarching core coding categories. This ultimately resulted in three main categories for teacher competency development: deep understanding of ESD concepts, lifelong learning integration competencies, and ESD teaching practice integration capabilities.

2.4 Data analysis

During the coding process, clear standards were established to determine the category of newly emerging open-ended codes, deciding whether to use existing labels, create new labels, or recode them. Simultaneously, the coding list was organized, and the number of codes and themes in each of the 10 university-related materials and 30 interview texts was counted. Based on the principle of interview saturation, after the interview samples covered different regions, types of universities, and teachers

and experts with diverse backgrounds, no new themes emerged from additional samples. Therefore, the study was deemed saturated, and the interviews were terminated.

Table 3 : Coding saturation test

Interviewee	Number of codes	Number of themes	Number of themes shared with the previous participant	Number of newly emerging themes	Total number of themes that have emerged
T1	8	6	-	6	6
T2	9	7	4	3	9
T3	7	5	3	2	11
T4	8	6	4	2	13
T5	10	7	5	2	15
T6	9	6	4	2	17
T7	8	5	3	2	19
T8	10	7	5	1	20
T9	9	6	4	2	22
T10	8	5	3	1	23
T11	10	7	5	2	25
T12	9	6	4	3	28
T13	8	5	3	3	31
T14	10	7	5	3	34
T15	9	6	4	2	36
T16	8	5	3	0	36
T17	10	7	5	2	38
T18	9	6	4	0	38
T19	8	5	3	2	40
T20	10	7	5	0	40
T21	9	6	4	0	40
T22	8	5	3	0	40
T23	10	7	5	0	40
T24	9	6	4	0	40
T25	8	5	3	0	40
T26	10	7	5	0	40
T27	9	6	4	0	40
T28	8	5	3	0	40
T29	7	4	3	0	40
T30	8	5	4	0	40

3.Results

3.1 In-depth understanding and knowledge of ESD concepts

Through the interviews with 30 lecturers or experts, it was found that the current teachers' understanding of the concept of ESD is diversified. Among them, about 30% of the teachers have a deeper understanding of the ESD concept, and they think that ESD is not only about environmental education, but also an educational concept that encompasses social, economic and cultural aspects (Ferguson, et al., 2021). A lecturer from an environmental science program said, "ESD is a comprehensive educational concept that emphasizes the development of an integrated understanding of environmental, social and economic sustainability. When explaining ecosystem conservation, one cannot just focus on the environment itself, but also need to guide students to think about the impact of ecological conservation on local economic development and social stability, as

well as how to achieve ecological balance in the process of economic development.”(Sarwar, et al., 2021) This understanding reflects teachers’ grasp of the multidimensional connotations of the ESD concept and their ability to organically link various aspects of sustainable development. However, there were also some limitations in the understanding of the ESD concept by about 50% of the teachers (Fndk, et al., 2021). Some teachers equate ESD simply with environmental education, ignoring its importance in the social and economic spheres. One liberal arts teacher mentioned, “I used to think that ESD is mainly about letting students know about environmental protection and developing their environmental awareness. However, through participating in relevant training and learning, I realized that ESD is much more than that, and involves many aspects such as social equity and sustainable economic development.” This limitation of understanding may result in teachers not being able to fully convey the concept of ESD in their teaching, leaving students with an incomplete understanding of sustainable development (Bezeljak, 2019). In addition, about 20% of the instructors had a vague understanding of the concept of ESD, having only heard of the terminology but not being able to accurately articulate its core connotations.

Table 4: Lecturers’ understanding of ESD and related teaching roles

Classification	Percentage	Viewpoint
Level of understanding of ESD concepts	30%	Perceived ESD as a comprehensive educational philosophy that encompasses social, economic, cultural and other dimensions
	50%	Limitations in understanding the concept of ESD, simply equating it with environmental education and ignoring the importance of the social and economic domains
	20%	Vague understanding of the concept of ESD, only heard of the terminology, not able to accurately describe the core meaning.
In-depth understanding of the role of ESD in teaching and learning	70%	Tend to use project-based learning, problem-based teaching, etc., so that students can experience and understand the meaning of sustainable development in practice.

In-depth understanding of the concept of ESD has an irreplaceable guiding value for teaching practice, which permeates many aspects of teaching goal setting, content selection, and methodological innovation, and provides a clear framework for teachers to carry out sustainable development education (Letouzey-Pasquier, et al., 2022). From the perspective of teaching objectives, a deep understanding of ESD can help teachers break through the single orientation of “knowledge transfer” in traditional teaching and build a three-dimensional objective system of “cognition-emotion-behavior. Teachers can clearly realize that sustainable education is not only to enable students to master the relevant knowledge of sustainable development, but also to cultivate their sense of responsibility for the coordinated development of the environment, society and economy, as well as their ability to transform knowledge into sustainable actions (Nurunnabi, 2024). In terms of content selection and organization, a deeper understanding of ESD concepts enables teachers to go beyond the limitations of teaching materials and build a more relevant and realistic content system. Teachers will take the initiative to select case materials that reflect the interaction between the environment, society and economy, and connect the fragmented knowledge points into a knowledge network of sustainable development. In terms of innovation in teaching methods, the deep penetration of ESD concepts will push teachers to transform from “lecture-based” to “participatory” teaching. About 70% of the teachers interviewed said that after gaining a deeper understanding of ESD, they more frequently adopt methods such as project-based learning, problem-oriented teaching, and community participatory practice, so as to let students experience the meaning of sustainable development in real situations. In addition, a deeper understanding of ESD can help teachers to build a closed loop of “Evaluation - Reflection - Improvement”. Teachers will incorporate students’ awareness of sustainable development and collaborative problem-solving ability into the evaluation system instead of focusing only on the degree of knowledge mastery. By observing students’ sensitivity to environmental issues and concern for social justice in project practice, teachers can reflect on the inadequacy of the integration of ESD concepts in their own teaching, and then adjust their teaching strategies to form a continuous optimization of the teaching cycle.

3.2 Competence and Literacy for Integration with Lifelong Learning

Interview data showed that 90% of teachers generally recognized the importance of lifelong learning, but faced many difficulties in actually doing so. About 70% of the teachers said that due to heavy teaching duties, it was difficult for them to spare enough time for learning. A lecturer who holds a number of classroom courses reluctantly said that preparing lessons, attending classes, and correcting assignments every day already took up a lot of time, and that he did not have the energy to learn new knowledge and concepts. This situation is more common among many teachers, whose heavy teaching work has severely compressed their learning time. 60% of teachers mentioned that the lack of effective learning resources and learning platforms is also an important factor affecting their lifelong learning. In the information age, the speed of knowledge updating is fast, and teachers need to continuously acquire the latest knowledge and information. However, some schools have limited library resources and poorly constructed e-learning platforms, which make it difficult for teachers to access high-quality learning resources. One teacher reflected that the books in the school library were updated slowly and the latest research results on sustainable development were difficult to find. The resources on the e-learning platform were cluttered and lacked systematicity and relevance, and could not meet their own learning needs (Saleem, et al., 2023).

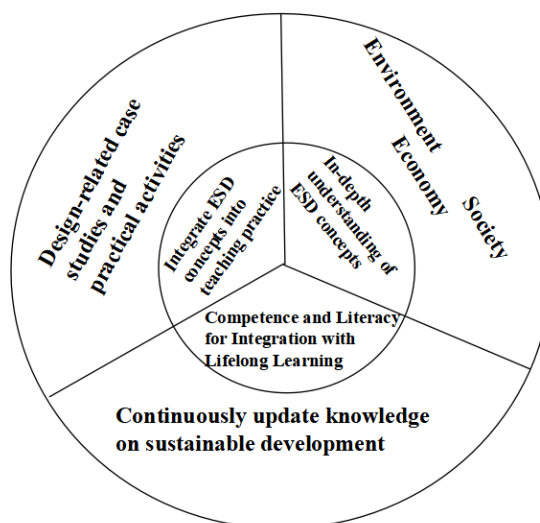
The importance of lifelong learning for teachers to adapt to the development of sustainable education is not only embodied in the superficial demand for knowledge iteration, but also penetrates into the core level of educational conceptualization and reconstruction of teaching competence, which is the core support for teachers to maintain their professional vitality in the wave of sustainable education. In terms of the dynamic nature of the field of sustainable development, its knowledge systems and practices are being updated at an unprecedented rate. About 80% of the experts interviewed pointed out that teachers in ESD must become ‘lifelong learners’, otherwise they will be reduced to ‘sounding boards of knowledge’ rather than ‘guides of sustainable development’. ‘. Lifelong learning can also help teachers cope with the ever-changing teaching objects and scenarios in sustainable education. Teachers need to understand the cognitive characteristics and concerns of their students through continuous learning, and adjust their teaching strategies to make their teaching content more acceptable (Yu, 2024). From the perspective of teachers’ own professional development, lifelong learning is an effective way to combat burnout and maintain enthusiasm for teaching. About 60% of the teachers interviewed said that when they master a new skill through learning and apply it successfully in the classroom, their professional self-confidence will greatly stimulate their teaching motivation, a positive cycle that transforms teachers from “passively adapting” to the requirements of sustainable education into “actively leading” sustainable education innovation.

3.3 Competence and Strategies for Integrating ESD Concepts into Teaching Practices

Interview data showed that teachers organically integrated ESD concepts into subject teaching by designing specific curriculum content. When a geography teacher explained the utilization and conservation of natural resources, he not only taught relevant geographic knowledge, but also guided students to explore the concept of sustainable development. He introduced some practical cases, such as the deterioration of the ecological environment due to the over-exploitation of mineral resources in a certain region, and asked students to analyze the problems and propose solutions for sustainable development. In this way, students not only grasped geographic knowledge, but also deeply understood the importance of sustainable development. Some teachers allowed students to experience and understand the concept of ESD in practice by organizing rich and diverse teaching activities, such as field trips, group discussions and project-based learning. A biology teacher organized a field trip to a local nature reserve for students to experience the diversity and fragility of ecosystems (Jeong, 2024). During the field trip, the teacher guided the students to observe the living environments of plants and animals, and to understand the balance mechanism of the ecosystem and the impact of human activities on the ecosystem.

However, there are some problems in integrating the ESD concept into teaching practice. Although some teachers recognize the importance of the ESD concept, they have difficulty in integrating it effectively into their teaching due to a lack of relevant teaching experience and methods. A newly recruited teacher said that although she was aware of the importance of the ESD concept, she did not know how to translate the concept into concrete teaching contents and activities in actual teaching and felt that she had no way to start. This situation is more common among some young teachers, who lack teaching experience and are not yet skilled enough to understand and apply the ESD concept.

Figure 1: Core elements of teacher capacity building



4. Discussion

4.1 Characteristics of educational resources in UNESCO heritage sites

UNESCO heritage sites cover a rich variety of natural and cultural resources, which are of high educational value and provide unique materials and scenarios for teachers' capacity building (Shutaleva, et al., 2020). Take China's World Natural and Cultural Heritage Site of Mount Tai as an example, Mount Tai has majestic natural landscapes, its unique geological structure and rich vegetation types, which are vivid teaching materials for natural science education. The stratigraphic landforms of Mount Tai record the long evolutionary history of the earth. Teachers can lead students on field trips so that they can experience the wonders of nature and learn about geological evolution, ecosystems and other aspects. Mount Tai also carries a deep cultural heritage. From ancient times to the present, countless literati and artists have left precious poems and songs and inscriptions on the cliffs, and these cultural relics have witnessed the development of China's history and the inheritance of culture. Teachers can guide students to appreciate these cultural works, understand the thoughts and feelings and aesthetic concepts of ancient literati, and cultivate students' cultural literacy and aesthetic ability.

The natural and cultural resources of UNESCO heritage sites can provide teachers with rich teaching materials and make the teaching content more vivid, concrete and real. Teachers can use these resources to design diversified teaching activities, such as field trips, cultural experiences, case studies, etc., so that students can learn and grow in practice and increase their interest and participation in learning. These resources can also broaden teachers' horizons, enrich their knowledge base and enhance their professionalism, so that they can better adapt to the needs of sustainable education.

4.2 Utilizing heritage sites for environmental training and field trips

Utilizing UNESCO heritage sites for environmental training has significant advantages. Take Wuyi Mountain National Park as an example, as a double world cultural and natural heritage, it has rich natural resources and unique ecosystems. The park preserves a large number of rare plant and animal species and is a natural laboratory for studying biodiversity and ecosystems. Teachers can organize students to participate in environmental training activities in Wuyishan National Park, inviting professional ecologists to explain to students the structure and function of the ecosystem, the significance of biodiversity conservation and the impact of human activities on the ecological environment. In the environmental training, students can also be arranged to participate in actual ecological protection work, such as participating in the monitoring of forest vegetation, wildlife protection surveys, etc. Through these practical activities, students can not only master the skills of ecological protection, but also enhance their sense of responsibility and protection of the natural environment.

4.3 Interactive teaching and knowledge sharing model based on heritage sites

Project-based learning is also an effective interactive teaching method. Teachers can design project-based learning activities around the Dunhuang Mogao Grottoes, such as allowing students to work in small groups to study the artistic characteristics, historical evolution, and conservation status of the Dunhuang Mogao Grottoes, and to present their research results by making

PPTs, writing reports, and organizing exhibitions. In the process of project implementation, students need to independently access data, collect information, analyze problems, solve problems, which can not only improve students' learning ability and practical ability, but also cultivate students' teamwork and communication skills. Group discussion is also a commonly used interactive teaching methods, teachers can organize students for the protection and development of Dunhuang Mogao Grottoes group discussion, so that students express their views, share their own views and ideas, and promote the collision of ideas and exchanges between students.

Teachers can also make use of the online platform for knowledge sharing, such as setting up teachers' forums and blogs to share their teaching tips, teaching resources and teaching cases. Through the online platform, teachers can break the limitations of time and space, communicate and cooperate with more teachers, and obtain more teaching resources and support. After visiting the Forbidden City Museum, a teacher posts his/her teaching tips and designed teaching programs on the teachers' forum, where other teachers can comment and make suggestions to improve the teaching programs together. This knowledge-sharing model can promote mutual learning and common growth among teachers, and improve their professionalism and teaching level.

5. Practical Strategies

5.1 Policy support and institutional guarantee

At the international level, many countries have introduced relevant policies to provide strong support for teacher capacity building in the sustainable education system. Australia has formulated detailed professional standards for teachers, which explicitly include education for sustainable development and require teachers to have knowledge and skills of sustainable development and be able to integrate them into teaching practice. The Opinions on Promoting the Reform of Comprehensive Evaluation of the Quality of Primary and Secondary Education Issued by the Ministry of Education of China emphasize the importance of cultivating students' social responsibility, innovation and practical ability, which highly fits the goals of education for sustainable development. goals highly compatible with sustainable education. In order to enhance teachers' competence in sustainable education, education departments around the world have organized a variety of teacher training activities (Vieira, et al., 2021), inviting experts and scholars to give lectures and trainings, and sharing the concepts and practical experiences of sustainable education.

In order to further improve the policy system and institutional guarantee, it is necessary to start from several aspects. The government should increase its investment in sustainable education and set up a special fund to support teacher training, curriculum development and teaching practice. Relevant laws and regulations should be formulated to clarify the status and role of sustainable education in the education system and to provide legal guarantee for teachers' capacity building. Establish a sound evaluation system for teachers, incorporate sustainable education capacity into the index system for teachers' performance appraisal and title evaluation, and incentivize teachers to actively participate in the practice and research of sustainable education (Okulich-Kazarin, 2025). Schools and educational institutions should also establish corresponding systems to facilitate teachers' participation in training and practice. Schools can formulate teacher training programs, rationally arrange teachers' training time, and ensure that teachers can participate in all kinds of training activities. Teacher learning communities should be established to encourage teachers to communicate and share experiences with each other, so as to jointly improve their capacity in sustainable education. Schools can also cooperate with enterprises and social organizations to provide practice opportunities for teachers.

5.2 Mode of cooperation between educational institutions and heritage sites

At present, the cooperation between educational institutions and UNESCO heritage sites has achieved some positive results (Okuogume, 2024). Take the Cangdong Heritage Education Base as an example, it works closely with local schools to create a series of history and culture education programs. Students can visit the site to gain in-depth knowledge of history and culture, as well as participate in a variety of interactive activities to foster creativity and teamwork. Through archaeological excavations and historical document research, the Cangdong Heritage Education Base has reconstructed important historical scenes, providing students with the opportunity to experience the charm of ancient civilization first-hand and promoting the inheritance and promotion of history and culture. In terms of the cooperation mechanism, the two sides usually define their

respective rights and obligations by signing a cooperation agreement, and jointly formulate cooperation plans and project programs. The cooperation covers various aspects such as curriculum development, teaching practice and teacher training. In terms of curriculum development, educational institutions and professionals from heritage sites work together to transform the educational resources of heritage sites into curriculum content suitable for students. Teachers can design targeted teaching activities, such as field trips, cultural experiences and project-based learning, according to the characteristics of the heritage sites, so that students can learn and grow in practice.

5.3 Teacher Training and Professional Development Paths

Teacher training programs for sustainable education should include rich contents. In terms of theoretical knowledge, it should cover the basic theories of sustainable development, environmental sciences, social sciences, economics and other fields, so that teachers can have a comprehensive understanding of the connotation and extension of sustainable development (Persson, et al., 2023). Teachers are trained to master the teaching methods and strategies of sustainable education, such as project-based learning, inquiry-based learning, case study teaching, etc., so that they can utilize diversified teaching methods to carry out teaching activities. The training method can be a blended training mode combining online and offline. Online training can utilize online platforms to provide rich learning resources (Chiner, 2025), such as video lectures, online courses, e-books, etc., so that teachers can learn anytime and anywhere. Offline training, on the other hand, can organize centralized lectures, seminars, workshops and other activities to allow face-to-face exchanges and interactions among teachers and enhance the effectiveness of training. Experts and scholars can also be invited to provide on-site guidance, answer teachers' questions and provide professional advice and opinions (Albert, 2022).

Teacher professional development is a long-term process that requires the construction of a sound support system. Schools and educational institutions should set up teacher professional development files to record the learning and growth process of teachers and provide them with personalized development advice and guidance. Teachers are encouraged to participate in academic research and teaching reform programs, and are provided with the necessary research funding and resource support so that they can continuously improve their professionalism in research and practice.

6. Conclusion

Based on a sample of 10 universities in China, this study combines classroom observation with in-depth interviews with 30 lecturers and experts to explore teacher capacity building in the sustainable education system, identify the core elements, reveal the role of UNESCO heritage sites, and propose practical strategies. The study found that the core elements of teacher capacity building include in-depth understanding of the concept of ESD, the ability to integrate with lifelong learning, and the ability to incorporate the concept of ESD into teaching practice, which are all interrelated. Currently, there are specific problems such as cognitive limitations, obstacles to learning, and insufficient practical transformation of these elements among the teachers, with only 30% of the teachers being able to grasp the multidimensional connotation of ESD comprehensively, and 70% of them being affected by the heavy teaching load. Only 30% of teachers are able to fully grasp the multidimensional meaning of ESD, and 70% of teachers are affected by their heavy teaching load. UNESCO heritage sites, with their rich natural and cultural resources, can provide a unique path for teachers' capacity building. They can help teachers deepen their understanding of ESD through real-life materials, enhance their awareness of sustainable development through environmental training and field trips, and cultivate relevant teaching skills through interactive teaching. To promote teacher capacity building, it is necessary to build a "policy-resource-cooperation" trinity system, improve the policy and evaluation mechanism, optimize learning resources, and deepen the cooperation between educational institutions and heritage sites. At the same time, it is necessary to adopt measures such as precise training for the shortcomings, establish a flexible learning system, and promote long-lasting cooperation, so as to help teachers achieve the goal of "knowledge transmitter" from the "knowledge transmitter" to the "teacher". "knowledge transmitters" to "sustainable development guides", and provide support for the implementation of sustainable education.

Funding

no

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper.

Reference

- [1] Malik, M. S. K., Qi, Z., Iqbal, M., Zamir, S., & Malik, B. F. (2022). Education for sustainable development: Secondary school teacher's awareness and perception of integration. *Sustainable Development*, 31(3), 1515–1525.
- [2] Letouzey-Pasquier, J., Gremaud, B., Blondin, S., & Roy, P. (2022). Development of teachers' practices in the field of education for sustainable development (ESD): a discursive community of interdisciplinary practices focusing on the theme of chocolate. *Environmental Education Research*, 29(8), 1155–1169.
- [3] Martínez Valdivia, E., Pegalajar Palomino, M.d.C. and Burgos-Garcia, A. (2023), "Active methodologies and curricular sustainability in teacher training", *International Journal of Sustainability in Higher Education*, Vol. 24 No. 6, pp. 1364-1380.
- [4] Vieira, M.-J., Ferreira, C., Rodríguez-Esteban, A., & Vidal, J. (2021). Towards Sustainable Development in Education: Implementing a VET System for In-Service Teachers in Albania. *Sustainability*, 13(16), 8739.
- [5] Bezeljak, P., Torkar, G., & Scheuch, M. (2019). Understanding of sustainability and education for sustainable development among pre-service biology teachers. *Proceedings of The International Conference on Research in Teaching and Education*, 12(17).
- [6] Yu, B., Guo, W. Y., & Fu, H. (2024). Sustainability in English Language Teaching: Strategies for Empowering Students to Achieve the Sustainable Development Goals. *Sustainability*, 16(8), 3325.
- [7] Persson, C., Einarson, D., & Maria Melén. (2023). Educating the educators to be a driving force in higher education towards sustainable development. *International Journal of Sustainability in Higher Education*.
- [8] Ferguson, T., Roofe, C., & Cook, L. D.. (2021). Teachers' perspectives on sustainable development: the implications for education for sustainable development. *Environmental Education Research*(2), 1-17.
- [9] Saleem, A., Aslam, S., Sang, G., Dare, P. S., & Zhang, T.. (2023). Education for sustainable development and sustainability consciousness: evidence from malaysian universities. *International Journal of Sustainability in Higher Education*, 24(1), 193-211.
- [10] Okulich-Kazarin, V.. (2025). Sustainable development goal 4 and education research: a review of polish specifics against the background of global trends. *Sustainability (2071-1050)*, 17(6).
- [11] Okuogume, A., & Toledano, N.. (2024). Co-creation in sustainable entrepreneurship education: lessons from business–university educational partnerships. *Sustainability (2071-1050)*, 16(6).
- [12] Chiner, E., & Mermamolina, G.. (2025). Teacher and school mediation for online risk prevention and management: fostering sustainable education in the digital age. *Sustainability (2071-1050)*, 17(8).
- [13] Albert, M., & Uhlig, M.. (2022). Education for sustainable development at chemnitz university of Technology. *International journal of sustainability in higher education*.
- [14] Sarwar, S., Streimikiene, D., Waheed, R., & Mighri, Z.. (2021). Revisiting the empirical relationship among the main targets of sustainable development: growth, education, health and carbon emissions. *Sustainable Development*, 29(2).
- [15] Shutaleva, A., Nikonova, Z., Savchenko, I., & Martyushev, N.. (2020). Environmental education for sustainable development in russia. *Sustainability*, 12(18), 7742.
- [16] Fndk, L. Y., Bayram, L., & Canaran, Z.. (2021). Pre-service english language teachers' conceptions of sustainable development: a case from turkish higher education context. *International Journal of Sustainability in Higher Education*, 22(1), 423-456.
- [17] Jeong, J. S., & David González-Gómez. (2024). Sustainable development of steam and mathematics education with active and innovative methodology. *Sustainability*, 16(2), 6.
- [18] Nurunnabi, M.. (2024). Students' perception of sustainable development in higher education in saudi arabia. *Sustainability*, 16.