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C/O Suan Dusit Rajaphat University
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email:seaair.info@gmail.com
http://www.seaairweb.info/

SCOPING REVIEW ON THE PERSPECTIVE OF UNIVERSITY STUDENTS TOWARD EDUCATION FOR SUSTAINABLE DEVELOPMENT

Nur Fatini Syakirah Ahmad Fairos[1], Sharifah Intan Sharina Syed-Abdullah[1*] & Zakiah Ponrahono[2]

[1]*Faculty of Educational Studies, Universiti Putra Malaysia, Serdang, Malaysia.*
[2]*Faculty of Forestry and Environment, Universiti Putra Malaysia, Serdang, Malaysia.*

ABSTRACT

Sustainable Development Goals (SDGs) agenda remains 6 years before it ends, and yet the achievement towards it still needs to be taken seriously, especially for countries who still face challenges in achieving SDGs. Education for Sustainable Development (ESD) has been seen as a way to help the achievement of SDGs. Therefore, the need to implement ESD in higher education institutions (HEIs) has become paramount. This scoping review explores students' perspectives toward ESD in HEIs, which addresses two main research questions: 1) What are the students' perspectives on the role of ESD in preparing them for sustainability-related challenges in their future careers and personal lives? 2)What are the students' perspectives on suitable approaches for implementing ESD in higher education institutions?. The scoping review analysed 47 studies published between 2020 and 2024. The search was done using databases such as Scopus, Emerald and Google Scholar. By employing thematic analysis, the data were analysed deductively based on two themes that were predetermined, namely the importance of ESD and approaches for implementing ESD. The first theme refers to the importance of ESD, which emphasises fostering competencies like problem-solving and collaboration, students' awareness of ESD and promoting a positive attitude and behaviour toward sustainability. The second theme highlights approaches such as curriculum integration, right pedagogies and providing training to educators as key approaches to effective implementation of ESD. Based on the findings, this scoping review presented several recommendations for future scholars, educators, and policymakers to consider implementing ESD.

Keywords: scoping review, university students, perspectives, education for sustainable development, sustainable development goals

1. Introduction

In 2015, the United Nations introduced the Sustainable Development Goals (SDGs), a universal call to action to end poverty, protect the planet, and ensure peace and prosperity by 2030. These goals are structured across three main pillars: environmental sustainability, social inclusion, and economic growth. With only five years remaining until the SDGs' deadline, significant challenges persist, particularly in regions such as Asia and other developing countries, where progress toward achieving these goals has been slow. According to the 2024 Sustainable Development Goals Report, European countries are progressing faster compared to Asian counterparts (Sachs et al., 2024). This discrepancy stresses the need for enhanced and targeted efforts to accelerate progress toward these global objectives.

Education for Sustainable Development (ESD) has been increasingly recognized as a critical driver for achieving the SDGs. ESD promotes not only the acquisition of knowledge and skills necessary to address sustainability challenges but also fosters the development of attitudes, behaviors, and competencies that empower individuals to contribute to sustainable development (Braßler & Sprenger, 2021). Furthermore, in SDG 4 which refers to quality education, Target 4.7, highlights ESD plays a critical role in ensuring that all learners acquire the competencies to promote sustainable development, including global citizenship, cultural diversity, and appreciation of environmental stewardship (United Nations, 2015). By integrating sustainability into education systems, particularly in higher education institutions (HEIs), ESD helps students address complex global issues such as climate change, social inequality, and economic instability (UNESCO, 2013).

HEIs play a pivotal role in preparing students to become change agents for sustainability (Reza, 2016) and serve as important platforms for instilling sustainability competencies. The competencies include systematic thinking, anticipatory thinking, critical thinking, normative thinking, strategic thinking, problem-solving, self-awareness and collaborative skills (UNESCO, 2017). In this context, universities worldwide are increasingly incorporating ESD into their curricula to equip graduates as future leaders in achieving the SDGs, recognizing its relevance across disciplines and enhancing strategic commitments to sustainability in education (Price et al., 2024). Studies showed that there are an increase of sustainability knowledge, attitude and behavior when ESD is being integrated. For instance, Collado et al. (2022) found that participation in ESD interventions enhanced students' pro-environmental knowledge, personal environmental norms, and pro-environmental behaviors. As the study provided evidence of the increased quality of graduates through the implementation of ESD, it further justified the need for its implementation. However, Thompson (2023) mentioned that the implementation of ESD across universities varies significantly, with disparities in curriculum integration, teaching methodologies, and institutional support. Syed-Abdullah et al. (2023) further emphasised that universities adopt different approaches to implementing ESD, reflecting varying levels of institutional commitment and strategy. Their study identified four key approaches used to implement ESD in HEIs namely the organizational adoption approach, the competitive approach, the continuity approach, and the transformative approach.

It is noteworthy that as reported by Titisari et al. (2020), the perspectives of students toward ESD, especially regarding its relevance, accessibility, and the challenges they face in engaging with it, remain underexplored. Students, as the primary recipients and users of educational curricula, play a crucial role in shaping and benefiting from ESD. Moreover, they are recognized as agents of change capable of addressing global challenges (United Nations,

2015). Thus, capturing their perspectives is vital for designing effective and relevant ESD initiatives in higher education.

This study seeks to bridge these gaps by exploring students' views, with a particular focus on their perceptions of ESD's relevance and its implementation in HEIs. Given the breadth of this topic and the need to capture diverse perspectives across contexts, a scoping review is appropriate to comprehensively map the existing literature and identify research gaps. A scoping review methodology was employed, guided by Arksey and O'Malley's (2005) framework. This approach was selected because it aligns closely with the objectives of this study, which aims to comprehensively map the existing literature on students' perspectives toward ESD in HEIs. Scoping reviews are particularly appropriate when exploring emerging areas of research where the body of literature is broad, heterogeneous, or underdeveloped (Anderson et al., 2008). This methodology was deemed important to map the breadth and depth of existing literature, identify key themes, and clarify conceptual understandings related to ESD in higher education.

Unlike systematic reviews, which focus narrowly on study quality and specific outcomes, scoping reviews are valuable for examining emerging, complex, or interdisciplinary topics where definitions, approaches, and findings may vary widely (Munn et al., 2018). Findings from a scoping review may highlight the range of strategies and practices used to implement ESD, uncover gaps in current research, and offer a foundation for developing relevant frameworks or instruments for further study. In doing so, a scoping review contributes to a more comprehensive understanding of how ESD is perceived and practiced, particularly from the student perspective, which is often underrepresented in policy and curriculum discussions.

A review of the existing literature reveals significant gaps that this scoping review aims to address. While there is a growing body of research on ESD, most studies rely heavily on quantitative approaches, such as surveys and it focus on measuring university students' knowledge, attitudes, awareness, and behaviours related to ESD and SDG. However, limited qualitative or mixed-methods research was adopted which could provide deeper insights into students' lived experiences with ESD. This over-reliance on quantitative methods emphasizes the need for more diverse methodological approaches to provide a comprehensive understanding of students' perspectives toward ESD. In the context of Malaysia, studies exploring students' perspectives on ESD are particularly scarce, and existing research also tends to adopt predominantly quantitative methodologies. This lack of qualitative engagement limits a nuanced understanding of students' wants, needs, and expectations regarding the importance of ESD in their education and future careers. Consequently, by doing a scoping review focused specifically on university students' perspectives toward ESD is necessary to map, synthesise, and evaluate the existing literature. Such a review will not only identify prevailing themes and methodological trends but also highlight research gaps and underexplored areas.

This scoping review analysed 47 studies published between 2020 and mid-2024, with a focus on understanding students' perspectives toward ESD and the barriers and facilitators of its successful implementation in higher education. To achieve this, the following research questions were formulated:

1. What are the students' perspectives on the role of ESD in preparing them for sustainability-related challenges in their future careers and personal lives?
2. What are the students' perspectives on suitable approaches for implementing ESD in higher education institutions?

Through this scoping review, the study aims to inform educators, policymakers, and future researchers by mapping current knowledge, highlighting effective practices, and identifying challenges that hinder the broader integration of ESD in higher education.

2. Methods

As mentioned in the introduction, this study aimed to conduct a scoping review due to its benefits in providing a comprehensive overview of existing literature, identifying key themes, and uncovering research gaps related to students' perspectives on ESD in HEIs. This method is often confused with a systematic literature review. It is important to note that the two methods may be similar in their methodological steps, but they serve different purposes. Systematic reviews focus narrowly on a well-defined research question and critically synthesize results. Scoping reviews provide an overview of the available evidence without excluding studies based on rigid methodological criteria (Munn et al., 2018). Furthermore, scoping reviews are valuable for identifying key concepts, gaps, and patterns, offering insights for future research and practice (Peters et al., 2015; Gutierrez-Bucheli et al., 2022). This broad, exploratory approach is essential to capture the varied ways ESD is perceived and implemented across different contexts, something a systematic review's narrower focus would not accommodate at this stage. Therefore, a scoping review was adopted in this study.

Through the scoping review, this study analyzed literature related to the university students' perspective on the importance of ESD and suitable approaches to implement it. Furthermore, the researcher identified that most articles in the literature focus on specific themes, such as assessing the effectiveness of pedagogical approaches or measuring students' awareness of sustainability. However, this fragmented approach highlights a significant gap where no comprehensive literature review has been proposed to synthesize these diverse perspectives into a unified framework. To address this gap, this study categorizes students' perspectives based on multiple dimensions frequently explored in existing research, including knowledge, attitudes, competencies, perceived relevance to career and personal life, and preferences for implementation strategies. This multidimensional approach allows for the exploration of various aspects of the topic. In this case, the perspective of university students provides a broad understanding, as their views can encompass a wide range of factors related to ESD. For example, students' perspectives can reveal both the importance of implementing ESD (such as its relevance to their personal and professional growth) and the approaches that might be effective in integrating ESD into higher education institutions.

If the study were to focus only on specific keywords, such as "importance for implementing ESD," it would limit the scope of the findings to that particular area, potentially missing out on other crucial aspects such as the practical strategies, challenges, or student engagement with ESD. The multidimensional approach provided by the scoping review ensures that the research captures a comprehensive view of ESD from students' perspectives, which can include both the significance and the methods for its implementation, thus offering a more holistic understanding.

Additionally, these dimensions informed the development of the search strategy, ensuring that the selected search terms captured both general perspectives on ESD and specific constructs related to its implementation and impact. By consolidating findings across these dimensions, this review aims to provide a more holistic understanding to inform both research design and educational practice.

The scoping review is a useful method that quickly identifies research trends and results related to the research topic. It is also known for its ability to discover usable basic resources and core concepts of corresponding areas by including various types of research (Arksey & O'Malley, 2005). This scoping review process followed the framework proposed by Arksey and O'Malley (2005). According to Arksey and O'Malley (2005), there are 5 stages in building a scoping review: 1) Identify research questions; 2) Identify relevant studies; 3) Study selection; 4) Charting the data; 5) Collecting, summarizing and reporting the results. In the following section, the details of each of these stages are presented.

2.1 Identify the research questions

The formulation of research questions for this study was based on the PICO framework. Richardson originally developed the PICO framework et al. (1995) to structure clinical research questions but has since proven adaptable across various fields, including social sciences. Its ability to clarify key elements of research questions, such as population, intervention, and outcomes, makes it suitable for evidence-based reviews in non-clinical contexts. PICO is based on three main concepts, namely Population or Problem, Interest, and Context. Based on these concepts, the authors have included three main aspects in the review, namely university students (Population), perspectives (Interest), and education for sustainable development in higher education institutions' curriculum (context).

2.2 Identify relevant studies

The scoping review analyzed research papers that discussed higher education students' perspectives, attitudes, or engagement with education for sustainable development (ESD). The research papers were limited to those published from 2020 to 2024. Although the SDGs were introduced in late 2015 and early 2016, the years following 2020 have seen a significant acceleration in efforts to integrate sustainability into higher education, spurred by the UN's Decade of Action and increasing global awareness of sustainability challenges. By focusing on articles published between 2020 and 2024, this review captures the most recent advancements, practices, and perspectives on ESD. This period also reflects a critical phase in the implementation of SDG-aligned initiatives in higher education, ensuring that the findings are both contemporary and relevant to current educational and policy contexts. Older studies, while valuable, may not fully address the rapidly evolving discourse and practices in sustainability education during this time frame.

Based on the research questions, three main keywords were identified: university students, perspectives, and education for sustainable development. To expand on these keywords, the authors searched for synonyms, related terms, and variations using an online thesaurus (thesaurus.com). As a result, alternative keywords for 'university students' included 'higher education students' and 'college students.' For 'perspectives,' related terms included 'opinions,' 'views,' 'attitudes,' and 'perceptions.' Lastly, for 'education for sustainable development,' variations such as 'education for sustainability' and 'sustainability education' were also

included. The combinations of these keywords were processed using search functions in two databases: Scopus and Emerald (see Table 1).

The choice of keywords was directly informed by the research questions guiding this study. Both research questions explore university students' perspectives on ESD, specifically their views on ESD's role in preparing them for future sustainability-related challenges and on suitable approaches for implementing ESD in higher education. To address these questions, 'university students' was chosen as a primary keyword to ensure the focus remains on this specific population. 'Perspectives' was selected to capture the subjective viewpoints and experiences of students, encompassing a broad range of aspects, such as their prior knowledge, perceived importance of ESD, challenges they identify, and their recommendations for effective implementation. While the research question seeks to explore the roles and challenges of ESD, the study adopts a focused approach by prioritizing these three keywords. This approach is based on the assumption that examining students' perspectives will inherently reveal insights into both the perceived roles and challenges of ESD in higher education. This breadth aligns with the multidimensional research questions. Together, these keywords ensure that the search strategy is directly aligned with the study's objectives, facilitating the identification of relevant literature that addresses both the population (university students) and the thematic focus (perspectives on ESD).

Table 1: Search string used in selected database

Database	String
Scopus	TITLE-ABS-KEY ("university students" OR "higher education students" OR "college students") AND ("perspectives" OR "opinions" OR "views" OR "attitudes" OR "perceptions") AND ("education for sustainable development" OR "education for sustainability" OR "sustainability education")
Emerald	TITLE-ABS-KEY ("university students" OR "higher education students" OR "college students") AND ("perspectives" OR "opinions" OR "views" OR "attitudes" OR "perceptions") AND ("education for sustainable development" OR "education for sustainability" OR "sustainability education")

The scoping review included articles indexed in Scopus and Emerald databases, which are widely recognized for their comprehensive coverage of peer-reviewed literature across diverse disciplines, including sustainability and education. Scopus is one of the largest abstract and citation databases of peer-reviewed research literature, offering extensive coverage of relevant articles. It also offers extensive interdisciplinary coverage and high-quality indexing standards, making it ideal for identifying impactful research across fields, including education and sustainability (Falagas et al., 2008; Burnham, 2006). Emerald specializes in management, education, and social sciences, providing focused access to studies on sustainability and educational practices (Emerald Group Publishing, 2021). To expand this scoping review, the

researcher also used manual searching by using Google Scholar as a supporting database. Given these considerations, the selected databases were deemed sufficient to achieve the research objectives. For this scoping review, the researcher did not include WoS due to restricted access. However, future studies could consider integrating additional databases, such as Web of Science, to further enrich the review.

2.3 Study selection

Study selection was the third procedure carried out, where articles were either included or excluded (with the assistance of the database or manual screened by the authors) from the study based on a specific set of criteria (Table 2).

Table 2: The inclusion and exclusion criteria

Inclusion	Exclusion
Studies focusing on university students as the primary population.	Studies not focusing on university students as the primary population.
Articles published in English.	Articles published in non-English.
Articles which have open access	Articles which do not have open access
Articles published ≥2020	Articles published <2020
Articles discussing university students' perspectives, attitudes, or engagement with education for sustainable development (ESD).	Articles that do not address education for sustainable development or related concepts
Research addressing themes related to sustainability, environmental education, or sustainable development practices within higher education.	

The following Figure 1 presents the search results from Scopus and Emerald, an international database, using the strategies outlined in Table 1. Searches conducted across Scopus and Emerald databases initially yielded 920 papers. Additionally, 22 articles were added from Google Scholar through manual searching and resulting in 922 papers. Then, a total of 617 articles were excluded from the review during this stage since they were not in line with the inclusion requirement. This resulted in 305 remaining articles for evaluation in the subsequent stage. Duplicate articles were then removed based on title and author, reducing the count by 10. The authors manually checked the remaining papers to identify (either by reading the title, abstract or the entire paper) whether the papers matched the established inclusion criteria. 248 articles were excluded during this stage since they did not focus on the perspectives of university students toward SDG/ESD. Ultimately, 47 articles were finalised for inclusion in the study.

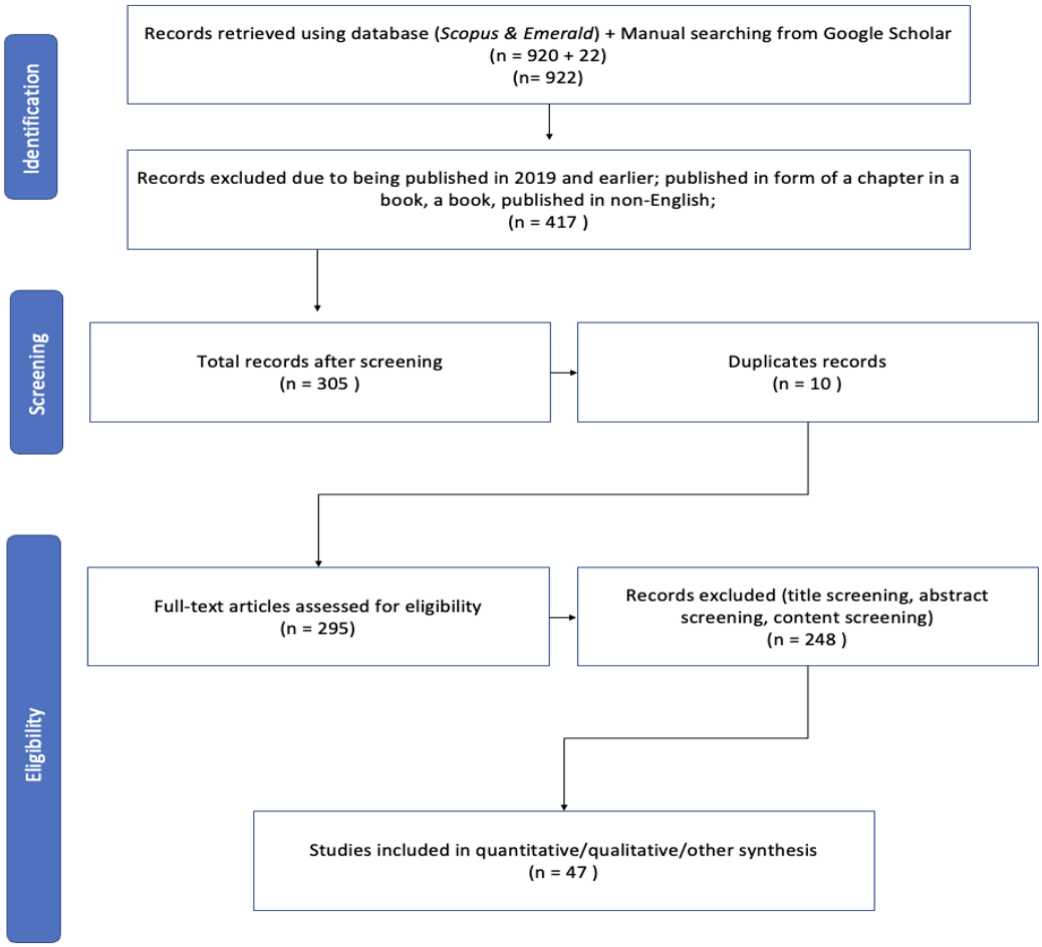

Figure 1: Flow Diagram of Included Studies

2.4 Data Extraction

To extract and organize the data, the author also recorded information of the review, so that the outcome is contextualized and more understandable to the reader. Below are the information included:

- author(s), year of publication, study location
- Intervention type/duration
- Study population
- Aim of the study
- Method
- Results

2.5 Collecting, summarizing and reporting the results

In conducting this scoping review, it is essential to include a diverse range of data to thoroughly address the study topic. Equally important is the way the included data are represented. According to Arksey & O'Malley (2005), it is also important to consider how the

data is shown. To comprehensively explore various research perspectives on students' views regarding the importance of ESD and effective approaches for its implementation, this review did not conduct quality evaluations of the included studies. According to Peter et al. (2015), the primary purpose of a scoping study is to map existing evidence rather than assess its quality. Consequently, scoping reviews aim to identify research gaps, summarize key concepts, and understand the range of available research rather than determine the robustness or generalizability of individual studies.

Using the collected data, this study examined the publication dates, study methods, countries of origin, and key findings of the included research. Additionally, information sources and specific information needs were summarized. As this study involves a review of existing research articles, it did not require ethical approval or individual consent (Jo et al., 2019).

A total of 47 articles were thoroughly reviewed and coded to address the research questions. Since a scoping review is used to systematically map existing literature and identify key themes, thematic analysis was employed as a complementary approach to interpret qualitative insights from the reviewed studies. This ensures that the findings go beyond a descriptive summary, allowing for a deeper exploration of patterns, recurring concepts, and emerging perspectives related to university students' views on ESD implementation. The integration of these approaches strengthens the paper's academic rigor by ensuring that findings are systematically categorized while capturing nuanced qualitative insights that might not be evident in purely quantitative syntheses. During open coding, initial codes were generated by reviewing the text of each article, and identifying recurring concepts, key phrases, and patterns related to the university students' perspectives on education for sustainable development (ESD). This phase was exploratory, allowing for the broad collection of data relevant to both research questions. For example, several articles examined how ESD interventions increased students' sustainability awareness (*e.g., "A factor analysis shows small but statistically different positive differences, which indicate that the revised curriculum has been successful in raising student awareness and achieving behavior " – Hay & Eagle, 2020*). This was initially coded under "raise awareness".

Following open coding, the identified codes were categorized into sub-themes by grouping similar codes that shared common characteristics or related to specific aspects of ESD. These sub-themes refined the analysis and provided a more nuanced understanding of various dimensions of students' perspectives, such as their views on ESD's role in preparing for future challenges or their preferred approaches to ESD implementation. For instance, related codes were grouped into sub-themes. In this case, the codes "raise awareness" and "improve awareness" were categorized under the sub-theme "Promoting Awareness", which encompasses students' recognition of sustainability issues and their perceived importance of ESD.

Finally, the sub-themes were organized into overarching themes, representing broader patterns that emerged across the articles. These overarching themes offer insight into the most significant findings related to the students' perspectives on ESD and its integration into higher education. For example, in the theme development phase, the sub-theme "Promoting Awareness" contributed to the broader theme of "The Importance of Implementing ESD." This overarching theme captures the essential role of ESD in shaping students' knowledge and attitudes toward sustainability.

The process followed the principles of thematic analysis as outlined by Braun and Clarke (2006), ensuring the analysis was both rigorous and aligned with the research objectives. The resulting themes are presented in Figure 5, Figure 6, Figure 7 and Figure 8, which provide a comprehensive summary of the key findings from the reviewed literature.

3. Results

3.1 Background of the reviewed literature

As mentioned earlier, 47 articles were analyzed in this scoping review. These articles are categorized by country, publication year, and methodology as in Table 3. Figure 2, 3 and 4 summaries of each category.

Table 3: Summary background of selected studies

Author(s)	Country	Year	Methodology
Albattah and Bande	Saudi Arabia	2023	Quantitative
Alrasheed and Hamdan	Saudi Arabia	2023	Qualitative
Balakrishnan et al.	Malaysia	2021	Quantitative
Collado et al.	Spain	2022	Quantitative
France et al.	United States	2022	Quantitative
Gomez and Garcia	Spain	2023	Mixed Methods
Hamón et al.	Spain	2020	Quantitative
Hay and Eagle	Australia	2020	Quantitative
Hyytinen et al.	Finland	2023	Quantitative
Ibrahim	Saudi Arabia	2021	Quantitative
Karin et al.	Sweden	2022	Quantitative
Liu et al.	Japan	2022	Mixed Methods
Llach and Bastida	Spain	2023	Quantitative
Maiorescu et al.	Romania	2020	Quantitative
Ngo and Chase	United States	2020	Quantitative
Sierra and Collado	Spain	2021	Quantitative
Suprapto and Hidayatullah	Indonesia	2023	Mixed Methods
Syed-Azhar et al.	Malaysia	2022	Quantitative
Thomas et al.	Japan	2023	Mixed Methods
Trechsel et al.	Switzerland	2023	Qualitative
Turner et al.	India	2022	Quantitative
Urbaniak et al.	United States	2024	Quantitative
Wang et al.	Netherlands	2022	Quantitative
Xing and Ironsi	China	2024	Quantitative
Zwolińska et al.	Poland	2022	Quantitative
Kalsoom et al.	Pakistan	2020	Quantitative
Syed-Azhar et al.	Malaysia	2022	Quantitative
Ribeiro et al.	Portugal	2023	Qualitative

Wang et al.	China	2020	Quantitative
Leiva-Brondo et al.	Spain	2022	Quantitative
Abowardah et al.	Saudi Arabia	2024	Quantitative
Fourati-Jamoussi et al.	France	2021	Quantitative
García-González et al.	Spain	2020	Qualitative
Al-Nuaimi & Al-Ghamdi	Qatar	2022	Quantitative
Nousheen et al.	Pakistan	2020	Quantitative
Saleem	Sweden	2022	Qualitative
Zhong et al.	China	2024	Quantitative
Sanjeez et al.	India	2024	Quantitative
Afroz & Ilham	Malaysia	2020	Quantitative
Saloovara et al.	Finland	2021	Qualitative
Smaniotto et al.	Italy	2020	Quantitative
Saqib et al.	Pakistan	2020	Quantitative
Aginako and Guraya	Spain	2021	Quantitative
De Moraes Prata Gaspar et al.	Spain	2023	Mixed Methods
Li et al.	China	2024	Quantitative
Yamano et al.	Japan	2024	Quantitative
Kızıloğlu and Karaboğa	Turkey	2024	Qualitative

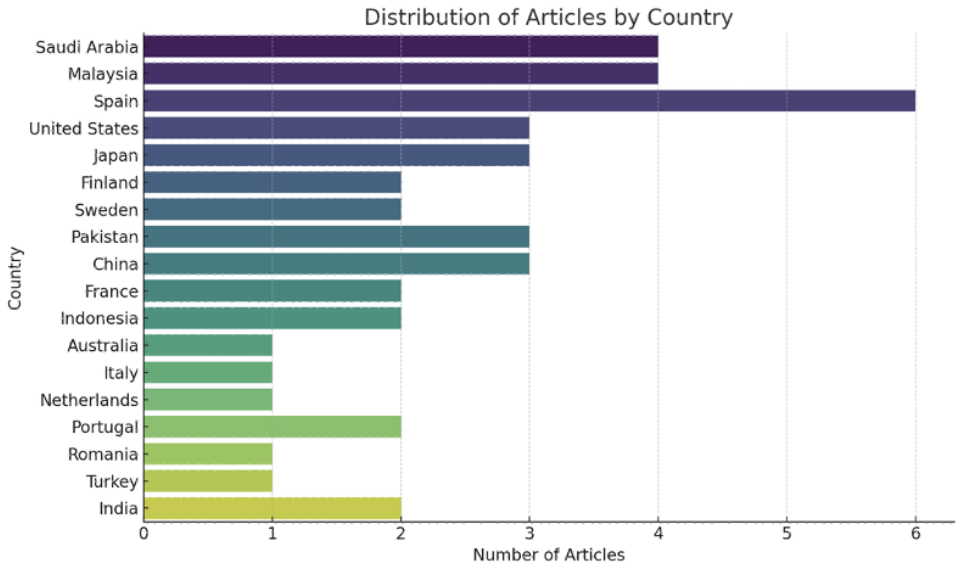

Figure 2: Distribution of Articles by Country from 2020-2024

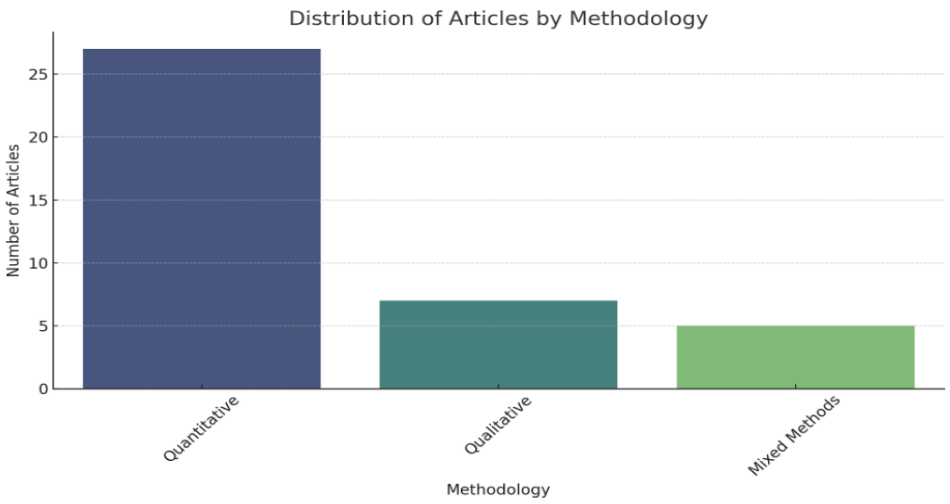

Figure 3: Distribution of Studies by Research Method from 2020-2024

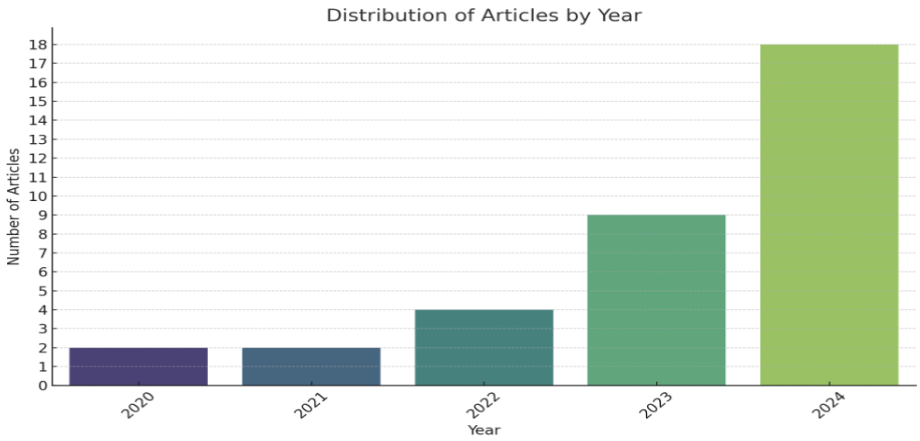

Figure 4: Distribution of Studies by Research Method from 2020-2024

The distribution of articles from 2020 to 2024 as in Figure 4 may be influenced by several factors, including national policies, support, awareness, prioritization, and current demand. As shown in Figure 2, Spain has the highest number of publications related to university students' perspectives on Education for Sustainable Development (ESD) in higher education, from 2020 to 2024. This is likely driven by the implementation of the Education and Sustainability in Higher Education (EDINSOST) framework, launched in 2016. Aligned with the European Union's sustainability goals, this initiative promotes the integration of sustainability into curricula across Spanish higher education institutions (HEIs). As part of Spain's commitment to sustainability, EDINSOST has significantly contributed to the rise in related research, including studies on student perspectives and engagement with sustainable development topics. The framework provides strategic guidance for universities to adopt sustainability practices, addressing not only environmental but also societal and economic dimensions, while encouraging the creation of sustainability-focused academic programs and research initiatives. Thus, the increase in publications from Spain between 2020-2024 can be

attributed to EDINSOST, which has acted as a mechanism for embedding sustainability in education and fostering academic research in the field (UNESCO, 2016; Sánchez-Carracedo et al., 2021).

Saudi Arabia and Malaysia have the second-highest distribution of articles. In Saudi Arabia, the increase in publications on ESD in higher education is linked to the Vision 2030 initiative, announced in 2016, which emphasized sustainability and innovation in all sectors, including education (Essa & Harvey, 2022). This has prompted Saudi universities, such as King Saud University and King Abdulaziz University, to introduce sustainability programs and research centres aligned with the Sustainable Development Goals (SDGs). Recent national educational reforms focusing on sustainability have accelerated the adoption of ESD practices in Saudi higher education, leading to a surge in research, particularly on student engagement and awareness of sustainability topics (Hassan et al., 2019). In Malaysia, while the Malaysia Education Blueprint does not explicitly mention ESD, it incorporates key elements aligned with ESD principles, such as holistic education, global citizenship, and higher-order thinking skills. Furthermore, government research grants that prioritize sustainability-related topics have encouraged more studies on ESD. Several universities, including Universiti Islam Antarabangsa Malaysia (UIAM) and Universiti Sains Malaysia (USM), have actively integrated ESD into their institutions, further contributing to the growing body of research on sustainability education in Malaysia.

Despite the lower number of articles from other countries such as Japan, United States, Australia, Finland, China and many more regarding university students' perspectives on ESD, this does not imply that these countries have not integrated ESD into their educational systems. Japan was one of the first nations to embed ESD into national policy, with the Japanese Ministry of Education, Culture, Sports, Science, and Technology (MEXT) supporting the integration of sustainability into higher education curricula (Nomura & Abe, 2021). The lower distribution of articles may be due to factors such as the limited scope of studies and year, which often focus specifically on student perspectives on the importance and implementation of ESD from 2020 to mid 2024. Additionally, language barriers and the accessibility of journals especially those published in English may restrict the visibility of research from non-English-speaking countries (Bahji et al., 2023).

3.2 Students' Perspective Towards ESD

This study aimed to investigate students' perspectives toward ESD based on two themes: the importance of ESD and approaches to implementing ESD. Table 4 shows the coding process that took place during the data analysis.

Table 4: Coding process

References	Themes	Sub-themes	Keyword
Alrasheed and Alghamdi (2022); Hyytinen et al. (2023); Karin et al. (2022); Trechsel et al. (2023); Llach and Bastida (2023); Wang et al. (2022).	Importance of ESD	Fostering competencies	Acquire both soft & technical skills Foster communication skills Enable see things from different perspectives Boost confidence Promoted students' autonomy Improved planning skills, time management, and accountability Develop interpersonal competence, self- regulation, critical thinking Enhance students' understanding Frame students' key competencies, interpersonal

			Develop soft skills Develop communication & management skills Develop collaboration and network skills Developed mental maps Learn to think more holistically Manage and control emotions Self-awareness Self-efficacy Reflection System thinking Normative Anticipatory Self-awareness
Albattah and Bande (2023); Turner et al. (2022); France et al. (2022); Hay and Eagle (2020); Gomez and Garcia (2023); Syed-Azhar et al. (2023).		Awareness	Promote environmental awareness Raise awareness Improve awareness
Urbaniak et al. (2024); Albattah and Bande (2023); Ngo and Chase (2020); Collado et al. (2022); Balakrishnan et al. (2021); Hamón et al. (2020).		Promoting positive attitude and behavior	Help change attitude for better Interested to promote sustainability Increase students' goal to address sustainability issues Enhance students' pro-environment behavior Increase sustainability behavior Engage in sustainability activities
Ngo and Chase (2020); Thomas et al. (2023); Liu et al. (2022); Zwolińska (2022); Turner et al. (2022); Balakrishnan et al. (2021); Ibrahim (2021).	Approaches for Implementing ESD	Curriculum	Formal teaching Incorporate sustainability element into education ESD intervention Interdisciplinary teaching and learning SDG project Environmental class curriculum
Suprapto and Hidaayatullaah (2023); Alrasheed and Hamdan (2023); Sierra and Collado (2021);Karin et al. (2022); Llach and Bastida (2023); Thomas et al. (2023); Turner et al. (2022); Balakrishnan et al. (2021); Hamón et al. (2020).		Pedagogy	Project based learning Active learning Interdisciplinary teaching and learning Field learning Work integrated learning Problem based learning Learner & action centred Interactive
Thomas et al. (2023);Gomez and Garcia (2023).		Training	Provide training to educators Need for teacher training

As shown in Table 4, there are two themes emerged from the data analysis, namely importance of ESD, and approaches for implementing ESD. Each of these themes can be further divided into several sub-themes. The themes and sub-themes were named based on the keywords identified from the reviewed literature. Table 5 and Figure 5 summarized these findings for this scoping review. The table also includes brief descriptions of the sub-themes.

Table 5: Summarized themes and sub-themes

Themes	Sub-themes	Description
Importance of ESD	Fostering competencies	Developing necessary skills and competencies that enable students to contribute effectively to sustainable development.
	Awareness	Enhancing students' understanding of global and local sustainability issues.
	Promoting Positive Attitudes and Behaviors	Encouraging attitudes that support sustainable development and proactive engagement with sustainability initiatives.
Approaches for Implementing ESD	Curriculum	Embedding SDG concepts into the curriculum enables students to contextualize sustainability within their academic disciplines.
	Pedagogy	Utilizing teaching strategies that promote hands-on, real-world applications of sustainability concepts.
	Training	Ensuring educators are trained in sustainability education, equipping them to teach and guide students effectively.

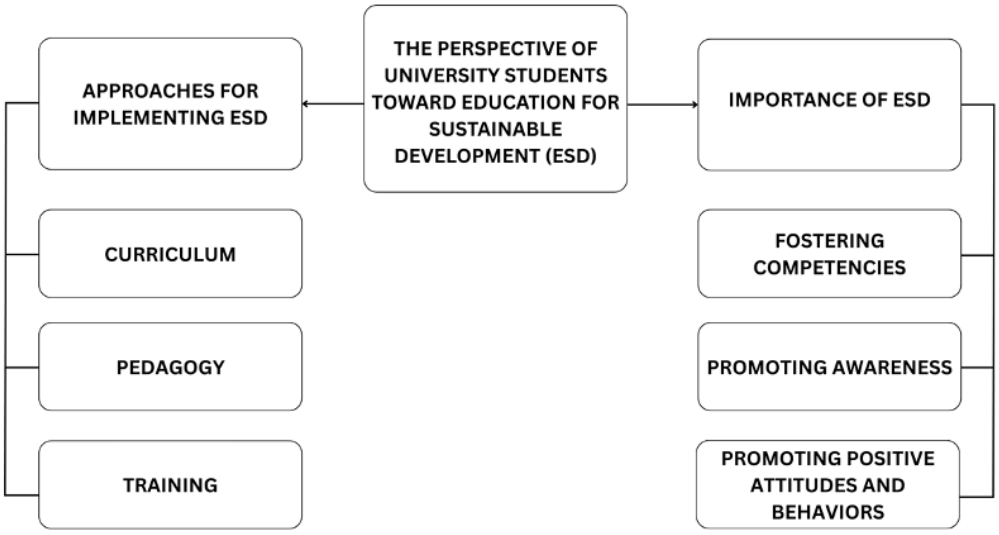

Figure 5: Summary of the findings

The findings for each of the themes are discussed in the following section.

4. Discussion

This part will further discuss the findings presented in the previous section. As presented in Figure 5 above, this scoping review identifies two main themes to answer the research questions namely 1) Importance of ESD and 2) Approaches for Implementing ESD.

4.1 Importance of ESD

The scoping review identified three importance of ESD from the perspective of university students.

4.1.1 Fostering Competencies

ESD is considered to have the potential to foster students' competencies, specifically sustainable competencies, which are crucial for contributing to sustainable development. Various competencies were identified in each article, according to their distinct references. Despite some variation, these competencies generally align with UNESCO's (2017) eight sustainability competencies: systems thinking, anticipatory thinking, normative thinking,

strategic thinking, collaboration, critical thinking, self-awareness, and integrated problem-solving. Each competency fulfils specific roles, reflecting students' nuanced views on ESD.

For example, systems thinking involves recognizing and analyzing complex relationships across domains and scales. This skill allows students to view sustainability challenges holistically, an essential attribute that Karin et al. (2022) noted as vital for understanding the global-local impact on systems. Similarly, Llach and Baltida (2023) highlighted that students who perceived systems thinking competencies approached problems through the three domains of sustainability which consist of society, environment, and economy by considering their interconnections at both local and global levels. This comparison reveals a shared emphasis on broad, interconnected thinking but also suggests subtle differences in how systems thinking is applied, hinting at diverse student interpretations of ESD's role in fostering these competencies.

Wiek et al. (2011) define anticipatory competency as the ability to envision and assess multiple future scenarios related to sustainability. This skill encourages students to understand sustainability as a long-term, intergenerational issue, highlighting the importance of forward-thinking in sustainable development (Karin et al., 2022). By fostering this competency, ESD equips students not only with the ability to project future impacts but also with a mindset that challenges short-term, and sustainable practices. Moreover, anticipatory competency prompts students to critically reflect on their own behaviors and the broader implications of their actions. As Llach & Baltida (2023) suggest, this competency drives students to reassess their daily choices and take proactive steps toward more sustainable lifestyles. This shift toward personal accountability suggests that anticipatory competency supports transformative learning, where students evolve from awareness to action-oriented change.

Normative competency, as defined by UNESCO (2017), is essential for fostering a sustainability mindset, requiring reflection on the values that guide actions and the negotiation of sustainability principles. Karin et al. (2022) found that students rated themselves highly in this competency, particularly in relation to ecological values. Similarly, Llach and Bastida (2023) reported that students believed they addressed normative competency by identifying values and beliefs tied to complex sustainability issues. However, such self-reported assessments may not accurately reflect students' depth of understanding or practical application of these principles. Comparing these perceptions with empirical assessments of normative competency in real-world scenarios could reveal whether this competency is truly developed or merely recognized as important by students, highlighting potential gaps between self-perception and practical skill.

Strategic competency, as defined by Karin et al. (2022) and Wiek et al. (2011), encompasses the ability to identify and address barriers to sustainability and to collaboratively develop and implement effective solutions. This competency is critical for students to collectively design and implement interventions, transitions, and transformative governance strategies that support sustainable change (Wiek et al., 2011).

Additionally, some studies do not specify the exact sustainability competencies they address, instead using broad terms such as interpersonal skills, communication skills, research skills, or overarching concepts like "learning to care," "learning to be," and "learning to transform," along with creative thinking, confidence, autonomy, networking processes, seeing things from different perspectives, values thinking, good communication, developing soft skills, fostering mindset and action-related competencies, and innovative strategies (Al Rasheed & Alghamdi,

2023; Hyytinen et al., 2023; Trechsel et al., 2023; Wang et al., 2022). However, these terms can still be connected to UNESCO's eight sustainability competencies (2017).

For instance, "interpersonal skills" and "communication skills" directly correspond to collaborative competency, which emphasizes effective communication and cooperation across diverse groups. As Karin et al. (2022) explained, interpersonal competency involves the ability to actively engage across cultural boundaries and integrate diverse perspectives. Similarly, "research skills" can be linked to systems thinking and critical thinking competencies, as conducting thorough research requires an understanding of complex systems and the ability to critically analyze information.

The terms "creative thinking" and "innovative strategies" closely align with strategic competency, which involves developing and implementing transformative solutions. "Confidence" and "autonomy" can be tied to self-awareness competency, reflecting an individual's capacity for independent action and self-reflection in sustainability contexts.

Furthermore, "networking processes" and "good communication" relate to collaborative competency, highlighting the importance of building relationships and sharing information for collective action. "Seeing things from different perspectives" directly relates to critical thinking competency, encouraging the questioning of assumptions and engagement with diverse viewpoints.

"Values thinking" is linked to normative competency, which emphasizes ethical reflection and the importance of guiding decisions through sustainable principles. The development of "soft skills" generally connects to both collaborative and self-awareness competencies, as these skills are essential for effective interaction with others and understanding one's personal strengths and areas for growth.

Finally, concepts such as "fostering mindset" and "action-related competencies" resonate with anticipatory competency and integrated problem-solving competency, both of which involve envisioning future scenarios and taking effective action to address sustainability challenges. By connecting these broad terms to specific competencies, the research offers a comprehensive framework for integrating sustainability education and fostering the competencies necessary for transformative change.

4.1.2 Promoting Awareness

Research consistently supports the idea that ESD plays a critical role in raising students' awareness of sustainability. Albattah and Bande (2023), Gomez Gomez and Garcia (2023), Fourati-Jamoussi et al. (2021) and García-González et al. (2020) found that students who took sustainability-focused courses demonstrated a significantly greater understanding of key sustainability issues. This suggests that integrating ESD into the curriculum deepens students' awareness and provides opportunities for meaningful engagement with environmental and social challenges.

Similarly, France et al. (2022) found that students exposed to sustainability content in engineering courses felt an enhanced sense of agency, particularly regarding improving their quality of life and preserving the environment. The study highlighted that ESD not only raises awareness but also fosters a sense of personal responsibility. Students reported gaining knowledge and adopting more sustainable behaviors, indicating that ESD promotes active involvement rather than passive consumption of information. Kalsoom et al. (2020) show that

many students have deep concerns about ESD and thought that it can change the environment. Turner et al. (2022) further supported these findings by demonstrating that integrating ESD into higher education institutions (HEIs) significantly enhanced students' sustainability knowledge, showing its broad applicability across disciplines.

However, while knowledge increases, these studies highlight that a shift toward sustainable actions is not automatic. Pedagogical strategies must be carefully designed to foster such changes. This shows the idea that awareness alone is insufficient; behavior change requires thoughtful curriculum design that goes beyond merely delivering information.

4.1.3 Promoting Positive Attitude and Behavior

The scoping review also revealed that exposure to sustainability initiatives plays a key role in shaping students' attitudes toward sustainability. Balakrishnan et al. (2021) emphasized that integrating ESD into courses helped facilitate the development of positive attitudes and perceptions toward sustainability. Urbaniak et al. (2024) found that STEM students who participated in sustainability-related initiatives reported stronger commitments to sustainable behaviors, attitudes, and knowledge.

This finding was echoed by Ngo and Chase (2020), who discovered that students involved in sustainability-focused projects gained a deeper understanding of the practical challenges associated with sustainability and were more likely to adopt pro-environmental behaviors. Additionally, Collado et al. (2022) demonstrated that participation in ESD interventions enhanced students' pro-environmental knowledge, personal environmental norms, and pro-environmental behaviors, with the positive effects persisting even one year after the program's conclusion. This shows that the students can contribute to a positive attitude and behavior when they are exposed to sustainability initiatives. Zhong et al. (2024) supported this by proving that students' sustainability cognition plays a mediating role and has a positive effect on enhancing sustainability behaviors through education.

Furthermore, Hamón et al. (2020) found that sustainability practices implemented by universities fostered consistent correlations between attitudes and behaviors across the three dimensions of sustainability. The engagement not only reinforced theoretical knowledge but also translated into a shift in attitudes as students realized their individual actions could contribute to larger sustainability goals.

However, a study by Al-Nuami and Al-Ghamdi (2022) reported even though students can grasp sustainability-related knowledge, but value gradually decreases in attitudes and behaviors. Sanjeev et al. (2024) explained the impact of knowledge on behavior is direct and partially mediated through the attitudinal pathway which indicates central and peripheral routes of sustainability-related information processing and attitude formation. These findings suggest that while students acquire sustainability-related knowledge, its impact on behavior is not always straightforward, as attitudes play a mediating role in shaping sustainability-oriented actions.

4.2 Approaches in Implementing ESD

4.2.1 Curriculum

The second theme identified relates to approaches for implementing ESD. Many studies prove the value of embedding ESD within curricula to equip students with the knowledge and skills

necessary for addressing sustainability challenges. For instance, a study by Syed-Azhar et al. (2020) shows that students agree that integrating sustainability into courses has improved their understanding of sustainability. Furthermore, Jones et al. (2023) highlighted that the inclusion of ESD within course curricula encouraged students to become more committed to achieving the goals by 2030. This finding aligns with the broader objective of ESD, which aims to develop active and informed citizens capable of contributing to sustainable development. Similarly, Ngo and Chase (2020) demonstrated that a project-based sustainability course positively influenced students' perceptions of sustainable practices and social change. The study highlighted the potential of multidisciplinary learning to enhance student motivation, foster engagement in sustainability-focused activities, and strengthen social interactions. Liu et al. (2022) further supported these findings by illustrating the benefits of incorporating interdisciplinary approaches to sustainability within non-environmental courses. This approach fostered collaboration among students and instructors from diverse academic backgrounds, broadening students' perspectives and enhancing their ability to integrate knowledge and communicate across different fields. Such interdisciplinary exposure plays a crucial role in preparing students to address complex sustainability challenges by developing skills in cross-disciplinary collaboration and adaptability qualities that are increasingly essential for fostering innovative solutions to sustainability issues. A study also highlights there is a need to promote the concept of sustainability in all its complexity and multidimensionality.

4.2.2 Pedagogy

While many studies advocate for integrating ESD within curricula, effective implementation requires more than mere curriculum revision. The literature highlights the need for appropriate pedagogical approaches to deliver sustainability content and ensure impactful student learning experiences. Turner et al. (2022) demonstrated a positive association between sustainability learning outcomes and the use of active, student-centred teaching approaches. Similarly, Alrasheed and Hamdan (2023) encouraged adopting student-centred learning, particularly through Problem-Based Learning (PBL). Their study found that PBL fosters a variety of skills, including confidence, autonomy, critical and creative thinking, long-term retention, communication, networking, and research skills. It also enabled students to approach problems from diverse perspectives. Llach and Bastida (2023) further supported these findings by showing that PBL scenarios effectively addressed multiple SDGs and fostering sustainability competencies. Students in their study highlighted key elements such as emotional involvement, self-reflection, freedom to approach problems, and the empowering role of tutors as essential for developing sustainability competencies. Additionally, Karin et al. (2022) demonstrated that Work-Integrated Learning (WIL) projects, which provide real-life experiences, significantly enhance students' understanding and interpersonal skills. This approach aligns to prepare students for real-world sustainability challenges. Xing and Ironsi (2024) also revealed that the action competence teaching model was effective in equipping students with not only knowledge about sustainability issues but also the confidence and willingness to act. Ribeiro et al. (2023) show the student's view on Service Learning (SL) experience was particularly helpful in promoting SDGs awareness in the recipients and predisposing them to change attitudes and behaviors.

Suprapto and Hidayatuallah (2023) argue that teaching methods must evolve alongside technological advancements, highlighting the critical need for ESD to remain adaptable to stay relevant and impactful. This perspective reveals the importance of integrating new technologies into ESD frameworks to enhance student engagement and learning outcomes.

Sierra and Collado (2021) found that active learning through games and simulations not only boosted student engagement but also increased awareness of sustainability issues. The positive student responses in this study show the potential of experiential learning to deepen understanding of sustainability principles more effectively than traditional methods. These findings collectively suggest that ESD benefits most from interactive, technology-enhanced pedagogies that mirror real-world sustainability challenges. Such approaches foster both student engagement and a practical understanding of sustainable practices. This alignment between pedagogy and real-world issues is essential for cultivating a lasting commitment to sustainability among students. Wang et al. (2022) further support this by demonstrating that the effectiveness of universal, broadly applicable pedagogies positively correlates with the development of students' sustainability mindsets, as well as their capacity for sustainability-related action and communication.

While these studies support ESD integration, effective implementation often requires a mix of formal and informal learning experiences. Turner et al. (2022) discovered that students reported learning the most about sustainability from the "hidden" or informal curriculum rather than formal classes, suggesting that incidental learning plays a crucial role in shaping student attitudes. This insight highlights a potential gap in current approaches, where formal education alone may lack the impact of experiential learning, underscoring the need for diverse pedagogies that balance structured content with informal learning spaces.

Moreover, Ibrahim (2021) found that students preferred integrating sustainability topics into existing courses to avoid an additional study load while learning how to incorporate sustainability into life and decision-making. This finding contrasts with Zwolinska et al. (2022), who advocated for both embedding ESD within existing courses and creating new programs specifically focused on sustainability. These contrasting perspectives suggest that curriculum flexibility is essential to enhance ESD's reach and impact.

While integrating ESD into curricula is important, evidence suggests that successful implementation depends on diverse, interactive pedagogies and informal learning opportunities. Institutions should consider approaches that extend beyond curriculum adjustments to support impactful instructional practices, informal learning spaces, and emotional engagement with sustainability topics. Future research could explore how formal and informal pedagogies together sustain students' commitment to sustainability beyond the classroom.

4.2.3 Training

Additionally, several studies recommend enhancing lecturers' competency in sustainability education through structured professional development and training. This approach aims to ensure that educators are well-equipped to guide students effectively. However, Thomas et al. (2023) caution that entrusting individual instructors with the primary responsibility for integrating ESD into their courses may lead to inconsistent implementation across programs.

Relying solely on individual educators risks uneven adoption, especially if lecturers lack a shared understanding or motivation to prioritize sustainability topics. Although training programs seek to prepare lecturers, their effectiveness and accessibility may vary. Students increasingly expect lecturers not only to possess expertise in sustainability but also to skillfully apply ESD resources, including local and global case studies (Thomas et al., 2023). These expectations highlight potential gaps that arise when lecturers are inadequately prepared, which could undermine the broader goals of sustainability education.

4.3 Addressing Literature Gaps

The findings from this scoping review highlight critical themes related to university students' perspectives on Education for Sustainable Development (ESD) and the best approaches for its implementation. These themes directly respond to key gaps identified in the literature by providing insights into how ESD fosters competencies, raises awareness, influences attitudes and behaviors, and informs effective implementation strategies.

One significant gap in the literature was the limited exploration of students' perspectives on ESD. The themes of fostering competencies, promoting awareness, promoting positive attitudes and behaviors, and approaches to implementing ESD address this gap by capturing students' perceptions of ESD, their motivations for engagement, and the factors influencing their participation. These themes provide a student-centred perspective, which has been underrepresented in prior research primarily focused on policy and institutional frameworks.

Another key gap was the fragmentation of findings on student engagement with ESD. Prior studies often examined isolated aspects of student engagement rather than presenting a comprehensive synthesis. The thematic structure of this scoping review bridges this gap by offering a cohesive view of how students perceive, internalize, and engage with ESD initiatives. The findings illustrate not only what students learn but also how they integrate sustainability concepts into their academic and personal lives.

Additionally, methodological limitations in prior research have contributed to an incomplete understanding of student engagement with ESD. While quantitative studies effectively measure knowledge acquisition and behavior change, they often fail to capture the depth of students' experiences and perspectives. In contrast, qualitative research, though limited in number, provides richer insights into students' understanding, challenges, and motivations. By analyzing both quantitative and qualitative studies together, this scoping review enables a more in-depth interpretation of the patterns identified in quantitative research.

For instance, a quantitative study by Leiva-Brondo et al. (2022) found that while many students reported being aware of sustainable development, most lacked a comprehensive understanding of its principles. A qualitative study by Kızıloğlu and Karaboğa (2024) further explored this issue, revealing that inadequate sustainability education and practices within universities contributed to students' limited understanding of sustainable development. This comparison brings out the value of integrating qualitative insights to explain why students, despite high self-reported awareness, may struggle to engage meaningfully with sustainability concepts.

By addressing these literature gaps, this scoping review provides a more holistic, structured, and contextually rich understanding of students' perspectives on ESD. The findings support the need for interdisciplinary approaches, improved institutional strategies, and targeted pedagogical interventions to enhance student engagement with sustainability initiatives in higher education.

5. Implications

This study offers several key implications for higher education institutions, policymakers, and students. For higher education institutions, it provides valuable insights into how curricula and pedagogical strategies can be adapted to better integrate sustainability education, aligning

with students' preferences and making sustainability more relevant within academic settings. The findings may also encourage universities to reinforce their commitment to sustainability by adopting supportive policies and fostering a campus culture that prioritizes sustainable development.

From a policy perspective, the study highlights potential gaps in existing educational frameworks and stresses the need for reforms that place greater emphasis on sustainability education. It emphasizes the importance of involving students in the design and implementation of sustainability initiatives, recognizing their role as key stakeholders in advancing sustainability goals.

For students, the research can raise awareness about sustainability challenges and empower them to engage more actively in sustainability initiatives both within and beyond their academic pursuits. By fostering a deeper understanding of sustainability, students may be inspired to adopt sustainable practices and contribute meaningfully to the pursuit of a more sustainable future.

6. Recommendations

This review highlights several critical gaps in the current body of literature on ESD. First, the lack of qualitative and mixed-methods studies limits a comprehensive understanding of students' nuanced perspectives on ESD. Employing these methodologies could offer deeper insights into how students internalize sustainability concepts and translate them into actions. Longitudinal studies are particularly valuable for exploring how students' learning experiences shape their behaviors and worldviews over time.

Another notable gap identified through this review is the overemphasis on the environmental pillar of sustainability, often neglecting the social and economic dimensions. Addressing this imbalance is crucial to ensuring that ESD reflects a holistic understanding of sustainability. Furthermore, most studies focus primarily on students in science disciplines, creating a gap in sustainability education for those in other academic fields.

To enhance the practical implementation of these recommendations, HEIs should adopt active learning strategies that go beyond traditional lecture-based instruction. Project-based and problem-based learning has proven effective in engaging students and fostering critical thinking, encouraging them to apply sustainability concepts in real-world contexts.

Educator training is equally critical to the success of ESD implementation. HEIs should provide structured training programs that equip educators with the necessary tools to teach sustainability in an interactive and interdisciplinary manner. Additionally, institutional commitment to ESD must be reinforced through clear policies and the establishment of dedicated working groups that oversee the integration of ESD into curricula and institutional practices.

By addressing these gaps and adopting a more inclusive, interdisciplinary, and action-oriented approach, HEIs can better equip students with the competencies needed to contribute to global sustainability efforts. These recommendations provide a roadmap for educators, policymakers, and researchers to enhance the implementation and effectiveness of ESD in higher education, ensuring that sustainability education is not only comprehensive but also impactful in shaping students' knowledge, attitudes, and actions toward a more sustainable future.

7. Conclusion

This scoping review examined 47 research articles to explore university students' perspectives on the importance of ESD and suitable approaches for implementing ESD in higher education institutions (HEIs). The study aimed to address two key research questions: 1) What are the students' perspectives on the role of ESD in preparing them for sustainability-related challenges in their future careers and personal lives? 2)What are the students' perspectives on suitable approaches for implementing ESD in higher education institutions?

In response to the first research question concerning students' perspectives on the role of ESD, three key sub-themes emerged: fostering competencies, increasing awareness, and promoting positive attitudes. Students generally perceive ESD as crucial for developing essential competencies such as critical thinking, problem-solving, and collaboration skills necessary for addressing global sustainability challenges. They also highlighted that integrating ESD into the curriculum raises awareness of sustainability issues and fosters positive attitudes and behaviors toward sustainable practices. Regarding the second research question, students indicated that the most suitable approach to implementing ESD is through embedding it into both the curriculum and pedagogy. Furthermore, they emphasized the need for training lecturers in sustainability concepts to enable them to teach and guide students more effectively.

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