



OPEN ACCESS

EDITED BY

Alberto Paucar-Caceres,
Manchester Metropolitan University,
United Kingdom

REVIEWED BY

Janika Leoste,
Tallinn University, Estonia
Claudia Fahrenwald,
University of Education Upper Austria, Austria
Fanuel Muindi,
Northeastern University, United States

*CORRESPONDENCE

Alejandro Álvarez-Vanegas
✉ aalvar17@eafit.edu.co

RECEIVED 09 September 2023

ACCEPTED 12 January 2024

PUBLISHED 05 February 2024

CITATION

Álvarez-Vanegas A, Ramani SV and
Volante L (2024) Service-Learning as a niche
innovation in higher education for
sustainability.
Front. Educ. 9:1291669.
doi: 10.3389/feduc.2024.1291669

COPYRIGHT

© 2024 Álvarez-Vanegas, Ramani and
Volante. This is an open-access article
distributed under the terms of the [Creative
Commons Attribution License \(CC BY\)](#). The
use, distribution or reproduction in other
forums is permitted, provided the original
author(s) and the copyright owner(s) are
credited and that the original publication in
this journal is cited, in accordance with
accepted academic practice. No use,
distribution or reproduction is permitted
which does not comply with these terms.

Service-Learning as a niche innovation in higher education for sustainability

Alejandro Álvarez-Vanegas^{1*}, Shyama V. Ramani² and
Louis Volante^{2,3}

¹Area of Natural Systems and Sustainability, Universidad EAFIT, Medellín, Colombia, ²UNU-MERIT, United Nations University, Maastricht, Netherlands, ³Department of Education, Brock University, St. Catharines, ON, Canada

Education for Sustainable Development (ESD) is a framework proposed by UNESCO to develop knowledge, skills, values, and behaviors in youth for sustainable development. As part of the global development agenda, higher educational institutions are expected to integrate ESD into their curricula. Service-Learning is a type of experiential learning in which students combine academic coursework with community service which is aligned with the learning objectives of their academic program. In light of the global trend, our paper investigates how universities are responding to this call through the introduction of Service-Learning programs. First, a comprehensive review of UN documents presents the background and structure of ESD. Second, a systematic review of the academic literature analyses how Service-Learning is being introduced in higher educational institutes. Key findings are that Service-Learning programs align with most of the UNESCO framework components, but higher education institutions are finding it challenging to implement them. Educators play a pivotal role in implementation, and unless they are trained and incentivized and this is systematized, not only Service-Learning but also ESD may fail to transform learning environments. Furthermore, there is a need for impact evaluation, particularly in terms of key sustainability competences. The three major challenges are insufficient educator capacity, funding, and educator attitudes. These challenges can be addressed through university-based projects addressing local problems that have a visible impact, as well as collaboration with local communities, other institutions and, social enterprises.

KEYWORDS

Service-Learning, multilevel perspective, ESD for 2030, higher education, SDGs

1 Introduction

In response to the social, ecological, and economic challenges that humanity faces today, the global development agenda of the United Nations proposes seventeen Sustainable Development Goals (SDGs) and proclaims a need for steering systemic change. Among these, SDG4 seeks to “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” (United Nations, 2015, 17) and sets ten targets for this purpose. Target 4.7 is particularly ambitious in its intention, namely “to ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace

and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development" (United Nations, 2015, 17).

Education for Sustainable Development (ESD) is founded on the premise that sustainable development requires social learning at the community level, as all economic actors need to participate in searching for pathways toward a more sustainable future (Barth and Michelsen, 2013). It is thus necessary to integrate ESD as a core element of policymaking and ensure that educational institutions support this mission effectively. Moreover, this means that the production and transfer of knowledge cannot be the only or most important task of educational bodies; skills and competencies must be developed in students so that the acquired knowledge leads to individual actions and collective solutions that promote sustainable development. How, then, can educational institutions respond to the call for integrating ESD into their curricula and train students to become sustainability champions? The present paper aims to contribute to this ongoing discourse by focusing on institutions of higher education, namely universities, and exploring the potential of a pedagogical strategy termed Service-Learning (SL).

SL can be understood as a: "credit-bearing educational experience in which students participate in an organized service activity that meets identified community needs and reflect on the service activity in such a way as to gain a further understanding of course content, a broader appreciation of the discipline, and an enhanced sense of civic responsibility" (Bringle and Hatcher, 1996, 222). It is thus a pedagogical strategy that exposes students to real-world experiences and allows them to learn and develop by contributing to a positive transformation in a community. Therefore, it is an excellent example of how a pedagogical strategy can help to untap the potential of universities to achieve the ESD vision. The central question of the present paper can now be reformulated: what are the potential and the limitations of SL as an instrument for the ESD missions?

Though ESD is meant to cover education at all levels, in this paper, we find it pertinent to have a narrower focus on Higher Education Institutions (HEIs) because there remains an urgent need to embrace sustainability more fully. The latter is evidenced in a survey conducted by the International Association of Universities in 2017, which showed that only 34% of the respondents (one hundred twenty universities) have adopted SD-related strategies (van't Land and Herzog, 2017). Thus, our study of SL in universities aims to add insight to this ongoing debate following a two-step methodology. First, a review of UNESCO and UN documents identifies the structure and priorities of the current ESD vision. Second, a systematic literature review analyses academic literature to answer the central research query on the integration of SL in universities, its role, and its impact.

The remainder of this paper is organized accordingly. Section 2 outlines the essential characteristics of ESD and its current policy framing. Section 3 details the systematic literature review, including the criteria for analysis. Section 4 presents the results of the systematic review of SL, discusses them, and offers recommendations for increasing the impact of SL programs. Section 5 provides key conclusions.

2 Background

2.1 Education as a means to achieve sustainable development

According to the Colombian philosopher Cayetano Betancur, "after accepting that education has ends, and that without them it is not properly conceived, the determination of those ends is linked to the problem of the very destiny of the human being" (Betancur, 2009, 27). For this philosopher, the definition of the purposes of education is linked to the future of humanity and, therefore, the answer to the question of 'what is education for?' involves considering the issue of 'what type of society is desired?'. Although it is an evolving concept to be approached critically, sustainability is an approximation to a consensus of what humanity wants and pursues, as well as an expression of our will to thrive and survive collectively and, equally important, of the societal conditions under which we want to achieve these critical goals. In this sense, education and sustainability are strongly related.

The importance of education and its role in societal transformation has been long recognized – from Aristotle in ancient Greece, who considered education more effective than law to avoid destabilization of society (Beatriz, 2014). The latter is precisely what sustainability is also meant to prevent. However, not every type of education leads to a better society. Today, education is far from reaching its potential to contribute to sustainable development: to allow and encourage students to engage with sustainability and contribute to shaping a better world, it needs to change and reorient toward sustainability principles, i.e., toward ESD (Rieckmann, 2011).

Since the adoption of the SDGs considerable efforts have been devoted to devising strategies for their realization. Nevertheless, HEIs are grappling with the challenge of adapting to new requirements urging the integration of sustainable development into their curricula and classrooms. Consequently, there is a pressing need for HEIs to offer hands-on learning experiences to young individuals in real-world contexts, particularly in the Global South. Thus, our research query is important for contemporary discussions given the urgent need for action against problems such as climate change.

According to Rey-Garcia and Mato-Santiso (2020), universities play a crucial role in achieving sustainable development through two primary avenues. First, by incorporating sustainable management practices into their operations and campuses (Filho et al., 2018). Second, by integrating sustainability policies, content, and tools into teaching, learning, research, and outreach activities (Filho et al., 2019). Higher Education for Sustainable Development is not only expected to create professionals and improve employability but also to equip individuals to become active participants in promoting sustainability democratically by providing them with the necessary learning experiences to contribute effectively toward achieving sustainability goals (Van Poeck, 2012).

It must be clear, though, that ESD does not seek to indoctrinate students. Instead, it aims to support individuals in reflecting on "their own actions by taking into account their current and future social and environmental effects – from a global perspective – and to intervene productively in shaping them in a sustainable manner" (Barth et al., 2016, p. 1). Furthermore, it "encourages changes in knowledge, skills, values and attitudes to enable a more sustainable and just society for all"

(Leicht et al., 2018a, p. 7). ESD has had an important focus on fostering key competences for sustainability (Brundiers et al., 2010; Rieckmann, 2011; Wiek et al., 2011; Brundiers et al., 2021). These competences will not be developed with traditional methods of teaching and learning. Instead, more active didactic strategies are required to achieve this purpose (Eilam and Trop, 2010; Molderez and Fonseca, 2018; Evans, 2019; Tejedor et al., 2019). UNESCO supports this view by stating that “action-oriented, innovative pedagogy to enable learners to develop knowledge and awareness and take action to transform society into a more sustainable one” (UNESCO, 2020, p. iii).

2.2 UNESCO’s mission for ESD

UNESCO has played a pivotal role in the development of ESD, which evolved within the broader discourse on sustainability, drawing strongly from the principles of environmental education. Leicht et al. (2018b) show the continuity of the dialog between education and sustainable development in the international agenda, tracing the origins of UNESCO’s involvement in environmental awareness and education to 1948 with the creation of the International Union for the Conservation of Nature, now the World Conservation Union. UNESCO remains a voice to the present day, as it has been entrusted to lead the ESD for 2030 agenda to support the attainment of the SDGs (UNESCO, 2020).

Education has played an essential role in all the relevant discussions around sustainable development: in the Stockholm Declaration (1972), the Brundtland Report (1987), and Agenda 21 (1992). Nonetheless, it was not until 2002, at the Johannesburg World Summit on Sustainable Development (WSSD), that the United Nations Decade on Education for Sustainable Development (2005–2014) (DESD) program was approved. In 2005, UNESCO unveiled an International Implementation Scheme for DESD. It was here that ESD was defined as a precise area in the sustainability discourse, and a vision for it was stated, namely, to shape a world “where everyone has the opportunity to benefit from education and learn the values, behavior, and lifestyles required for a sustainable future and for positive societal transformation” toward sustainable development (UNESCO, 2005, 6).

DESD had a mixed impact. A study on HEIs in Australia, Asia, and Europe concluded that the DESD accelerated efforts within academic institutions worldwide but at the same time recognized that the extent of integration varied considerably, and in many institutions, the learning outcomes for sustainability were not ensured (Sidiropoulos, 2018). For nations such as Germany and Sweden, the DESD was a push factor for strengthening ESD (Bormann and Nikel, 2017) and fostered its inclusion in curricula (Cars and West, 2015). In other less rich countries such as Kosovo, the DESD also led to promoting non-governmental organizations, such as the Kosovo Education for Sustainable Development, dedicated to fostering the inclusion of ESD in educational institutions and civil society (Beka, 2015). Moreover, in some European countries, such as Portugal, ESD policies and strategies were not integrated into HEIs (Farinha et al., 2018). Nonetheless, the activities of HEI experimenting with the integration of DESD stimulated the policy environment for ESD through communications and partnerships within HEI networks (Dlouha et al., 2018). An analysis of post-graduate urban studies in Europe, China, the USA and the Global South too suggests that there was progress toward the ‘whole-system’ transformation proposed by the DESD (Bina et al., 2016). Similarly,

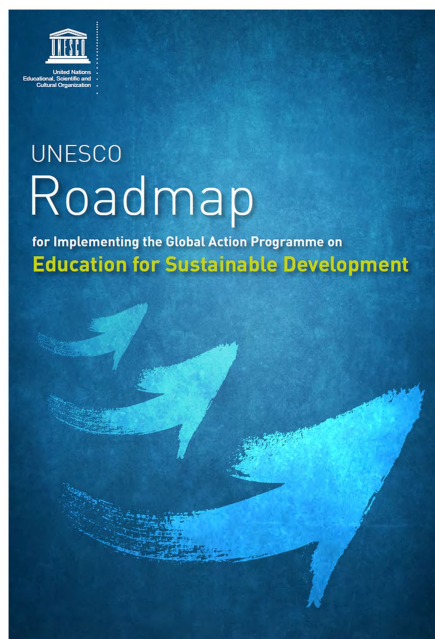
though the link with DESD is unclear, courses involving sustainability began to increase in engineering curricula (Colombo et al., 2015).

In a systematic review that aimed at outlining topics of research during the DESD, the authors noted that “fewer collected articles were concerned with UNESCO’s most strategic perspectives and most collected articles were concerned with UNESCO’s less strategic perspective” (Wu and Shen, 2016, p. 646). According to McKeown (2015), DESD strengthened a shared vision among educators, administrators, and educational organizations that allowed them to find a role for themselves in bringing ESD forward. NGOs and educational organizations such as nature centers and museums included strategies about and for sustainability, and many efforts related to ESD remain undocumented. Indeed, McKeown posits that “more ESD is carried out in the private sector—business and industry—than is reported in academic journals or in reports by provincial and national governments. Entire businesses have reorganized around the theme of sustainability, which demanded training for employees” (McKeown, 2015, p. 68). Conversely, Huckle and Wals (2015) claimed that the literature related to the DESD showed that it failed to acknowledge or challenge neoliberalism as a hegemonic force blocking transitions toward genuine sustainability. Despite these diverse results, it would be difficult to argue that the DESD did not serve to strengthen ESD. While a global paradigm shift was still a challenge, DESD reviews indicate significant work being done under ESD, but practical emphasis and development of this capacity are limited (Wals, 2015).

A Global Action Programme on ESD was launched in 2014 as a follow-up of the DESD. The increasing intention of action was prominent in this new program, as stated in its overarching goal: “to generate and scale up action in all levels and areas of education and learning to accelerate progress toward sustainable development” (UNESCO, 2014, p. 14). Besides its title, a further emphasis that the Global Action Programme made on action was the definition of five Priority Action Areas (PAAs) (Figure 1), whose purpose was to gain strategic focus and nudge all relevant actors to be actively involved (UNESCO, 2014).

The Global Action Programme overlapped with the beginning of the SDGs Agenda, which highlights education as a way for transformation. Beyond SDG4, education also figures in goals related to good health and well-being (SDG 3, Target 3.7), decent work and economic growth (SDG 8, Target 8.6), sustainable consumption and production (SDG 12, Target 12.8) and climate action (SDG 13, Target 13.3).

The Global Action Programme was accompanied by different reports and continuous complementing efforts vis-à-vis ESD. For instance, the Global Education Monitoring Report of 2016 was launched under the title ‘Education for people and planet: Creating sustainable futures for all’, exploring the links between education and the SDGs, emphasizing the targets of SDG4 (Global Education Monitoring Report, 2016). Also, in 2016, UNESCO published its framework for action, “Education 2030: Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4” (UNESCO, 2016). The action framework calls for a transformation in education so that students acquire not only knowledge (e.g., literacy and numeracy skills) but also social skills and action-learning competences, founded upon a reorientation of socio-emotional attitudes and behavioral changes. Thus, expanding content and exploring diverse pedagogical strategies are crucial to attaining this mission. The vision document does not favor any particular



PRIORITY ACTION AREA 1

Advancing policy: Mainstream ESD into both education and sustainable development policies, to create an enabling environment for ESD and to bring about systemic change

PRIORITY ACTION AREA 2

Transforming learning and training environments: Integrate sustainability principles into education and training settings

PRIORITY ACTION AREA 3

Building capacities of educators and trainers: Increase the capacities of educators and trainers to more effectively deliver ESD

PRIORITY ACTION AREA 4

Empowering and mobilizing youth: Multiply ESD actions among youth

PRIORITY ACTION AREA 5

Accelerating sustainable solutions at local level: At community level, scale up ESD programmes and multi-stakeholder ESD networks

FIGURE 1
Priority action areas proposed by UNESCO in 2014.

pedagogy but suggests: “using learner-centered, active and collaborative pedagogical approaches” (UNESCO, 2016, 33).

In 2019, with the Global Action Programme coming to an end and the SDGs still having ten years to be accomplished, UNESCO proposed a new framework for ESD under the title *Education for Sustainable Development: Toward Achieving the SDGs (ESD for 2030)* (UNESCO, 2020). It was developed in order to build a position that contributes to the Agenda 2030 through continued ESD activities support for SDGs, communication and advocacy in educational settings with explicit reference to SDGs, and ESD application to address interlinkages between SDGs (Shulla et al., 2020). Its overall goal is “to build a more just and sustainable world through the achievement of the 17 SDGs” (UNESCO, 2020, 14), as given in Figure 2.

ESD for 2030 continues to be guided by the PAAs outlined in the Global Action Programme, directing plans and actions. Moreover, three essential Key Notions (KNs) are emphasized as elements of reflection as the guiding principles for ESD:

- 1 Transform and empower learners: Transformative action should prioritize empowering learners to take transformative actions for sustainability, emphasizing the importance of exposing them to real-world situations and understanding their role in driving the societal transformation toward a sustainable future.
- 2 Deep structural changes: ESD needs to address the root causes of unsustainable development, striking a balance between economic growth and sustainable practices.
- 3 Harnessing technological future: ESD must adapt to the opportunities and challenges arising from technological advancements (UNESCO, 2020)

The priority action areas and key notions are two complementary concepts that work together to achieve the goal of ESD. The spirit of action and transformation is further stressed in its vision for global implementation, summarized in Figure 3. This completes our review of the UN and UNESCO documents.

2.3 SL as a niche ESD innovation in the HEI ecosystem

The multilevel perspective (MLP) is a framework for understanding system transitions (Rip and Kemp, 1998; Geels, 2002, 2010; Geels and Schot, 2007), which proposes that economic activities, including education, can be considered as the middle layer of a three-layered system. The topmost layer refers to the macro-landscape enforcing pressures that shapes and is shaped by the actions of economic actors. It includes both government enforced regulations as well as pressures created by human activity, such as climate change, demographic and economic trends, and societal dilemmas. The middle layer is the space of systemic activities where economic sectors function and thrive, and economic actors compete and cooperate with each other to create value and waste. They are governed by sets of self-reinforcing forces wielded by actor-coalitions that are collectively referred to as the dominant regimes. The bottom layer is the source of constant novelties or innovations that are introduced into the system, including by the state. The MLP framework has been used to explore the steering of sustainability transitions, i.e., comprehensive systemic changes that require cooperation and coordination between actors to move to more sustainable systems. The attainment of every SDG target can be considered a sustainability transition program. Thus, we can apply MLP to gain insight on how ESD can be integrated in HEIs.

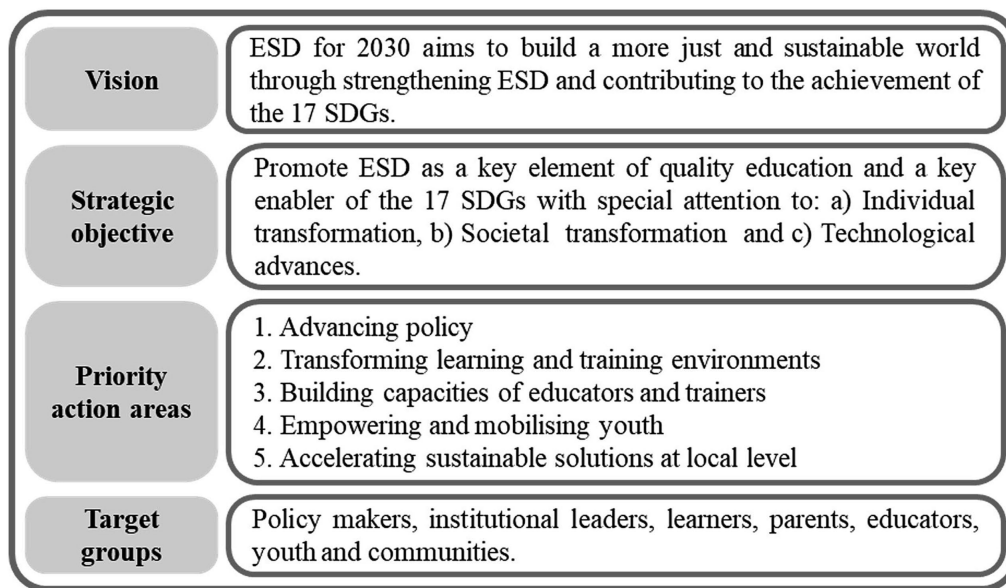


FIGURE 2
Vision, mission, action areas and targeted groups of ESD (adopted from UNESCO).

For instance, the HEIs in any country can be considered as economic actors in a system with other actors and actor-groups such as policymakers, institutional leaders, learners, parents, educators, youth and communities, as well as leaders/managers/workers of public agencies, firms etc. Like any other socio-economic system, the HEI ecosystem is characterized by the quantity and quality of its resources, artefacts, infrastructures (physical, institutional, financial, digital etc.), and their access to the different economic actors and the governance system and regulations (Deleye et al., 2019). It is, of course, marked by history, social norms, actor coalitions, actor capabilities and the performance of its artefacts and infrastructures. Systemic actors interact with one another through markets, hierarchies, and networks. Systemic outcomes depend on the nature of interdependencies between the actions of the different actors and actor groups, possible spillovers and externalities, and other system characteristics. Under this context, SL programs can be considered a niche innovation that is introduced in the HEI system to contribute to the priority action areas and key notions of ESD as summarized in Table 1. With this conceptual framework, we next turn to the methodology for the review of the academic literature to explore the integration of the niche innovation SL in the dominant regimes of the HEI system and its performance vis-à-vis the ESD criteria.

3 Methodology of literature review

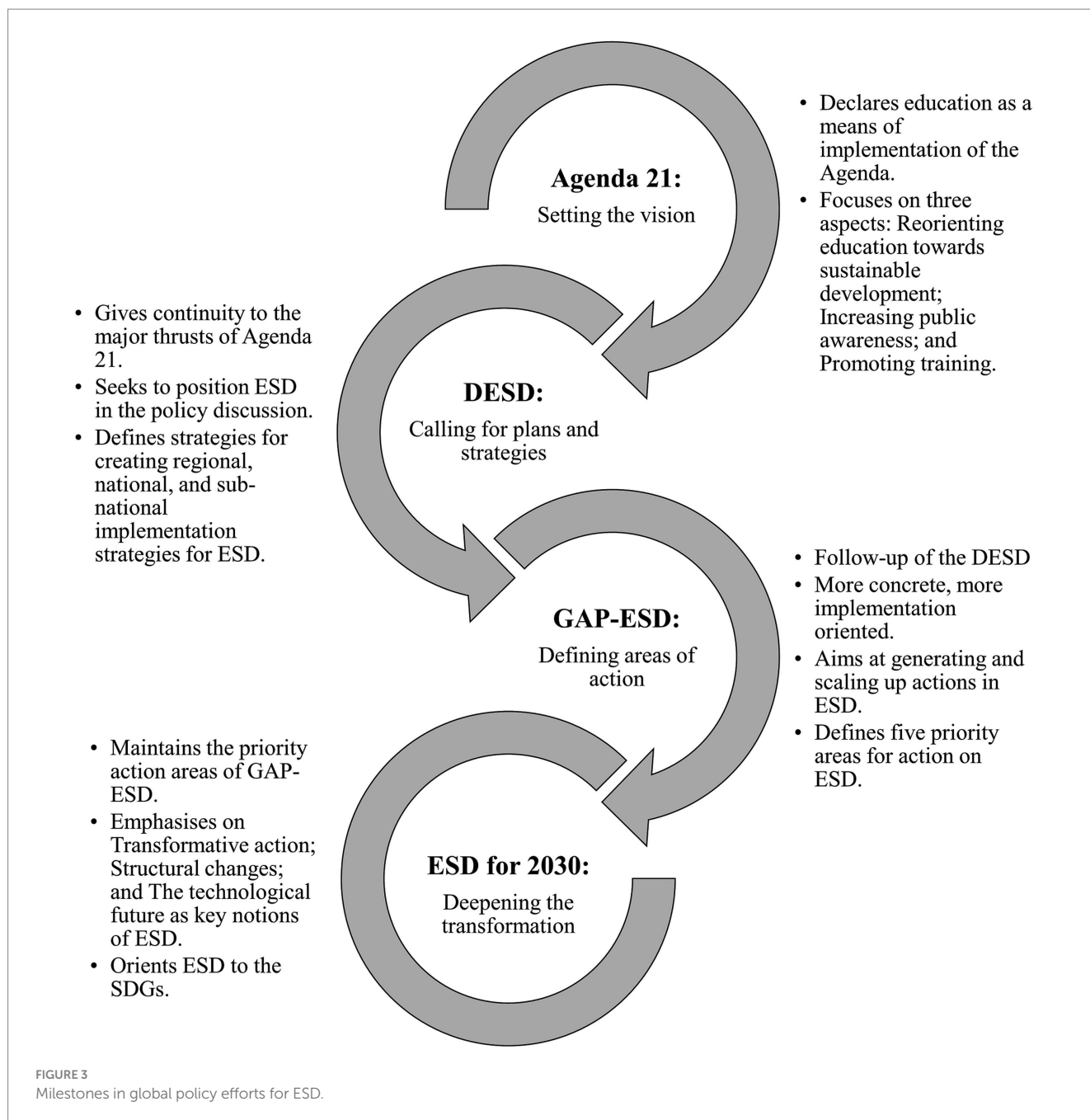
A systematic literature review refers to different methods to evaluate theories or evidence in a scientific way that guarantees replicability and transparency (Gough et al., 2017). It requires going through stages such as formulating a search equation, defining criteria for inclusion and exclusion, locating and selecting the studies, extracting data, and analyzing and interpreting results (Uman, 2011). Articles included in the review were selected through a systematic multi-stage procedure, following the standard steps of the Preferred

Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). PRISMA traces how a corpus of articles is built for a systematic review in a transparent, complete, and accurate way (Page et al., 2021).

Each article was thoroughly read, and its content was analyzed in two stages to filter and examine the most relevant content. First, each article was coded ('yes' or 'no') by the first author according to whether or not it dealt with one of the five specific PAAs and one of three KNs meant to guide progress, as proposed by UNESCO. Second, those articles with a positive code were read by the first author and discussed by the first and second authors until a consensus was reached on the insights provided toward the contribution of SL toward ESD goals via the PAAs and KNs. The third author conducted a comprehensive review of the consolidated information and provided feedback for incorporation in this second step.

3.1 Selection of articles

First, a comprehensive search for studies was performed on June 1, 2023, on the standard bibliographic database Scopus, searching with the equation ["Education for sustain*" OR "Sustainability education" AND "Higher education" OR "Universit*" AND "Service-Learning"] in title, abstract and keywords, from 1991 to 2022. This broad search included the terms "Education for Sustainable Development" or "Education for sustainability" to define the general area of study, and it narrowed the search to the higher education sector using "Higher education" OR "Universit*." The term "Service-Learning" aimed to further narrow down the results to those related to SL. Excluding book chapters, conference papers, and conference reviews, this search led to a set of 33 article abstracts in Scopus. The same search for articles was undertaken on the Web of Science platform with the equation [TS=("Education for sustain*" OR "Sustainability



education”) AND TS=(“Higher education” OR “University*”) AND TS=(“Service-Learning”). This search in TS (Topic) included title, abstract, author keywords, and Keywords Plus, and it yielded 27 results, but a closer look allowed us to identify two items as book chapters, and delete them, leading to a final set of 25 articles. Removing duplicated entries from the results obtained from both databases, finally 34 articles were found to analyze ESD in HEIs including SL. Note that our corpus focused uniquely on articles, i.e., book chapters, conference proceedings, etc. were excluded.

To delimit the final set of studies to be included in this systematic review, eligibility criteria were applied on the condition that the study had to evoke one of the PAAs or KNs in the title, abstract, or keywords.

All of them were found to potentially address at least one of the PAAs or one of the KNs. A PRISMA flow diagram based on Page et al. (2021) illustrates the selection of papers for inclusion and exclusion (Figure 4).

3.2 Qualitative content analysis

A full reading of the selected articles was performed to examine how the different PAAs and KNs were addressed by SL. To this end, criteria were established based on the guidelines of UNESCO and the definitions of the PAAs and the KNs (UNESCO, 2020), shown in Table 2.

TABLE 1 Sustainability transition in education.

Concept	Description
<i>Macro-landscape pressures on HEIs</i>	SDGs, SDG4, ESD for 2030, DESD & GAP programs, National Education Missions, Climate Change and Ecological Crises, Student unrest, Societal problems
<i>Dominant regime actors in HEI system</i>	HEIs, students, parents, academic staff at HEIs, non-academic staff at HEIs, firms, firm staff, NGOs, local and national public bodies and citizens
<i>Bottom-up innovations to be introduced into HEIs</i>	Learner-centered, active and collaborative pedagogical approaches such as SL
<i>Sustainability transition target of HEIs</i>	SDG target 4.7 – To ensure that all learners in HEIs acquire the knowledge and skills they need to promote sustainable development by 2030.
<i>Suggested pathways or priority action areas to achieve transition targets</i>	1. Advance Policy for ESD in HEI
	2. Transform learning environments of HEI
	3. Build capacities of educators
	4. Empower and mobilize youth
	5. Accelerate sustainable solutions at the local level through the HEI community
<i>Key notions or Guiding principles</i>	1. Transform HEI staff and students in terms of knowledge, skills, attitudes and behavior.
	2. Effectuate deep structural changes in the HEI system that will make its functioning more in line with sustainability goals.
	3. Ensure that the evolving technology is being used well and its risks are clearly being understood and addressed.

4 Results and discussion

4.1 Integration of ESD concepts in the SL literature

All priority action areas except ‘Advancing policy’ and all key notions except ‘The Technological future’ are well addressed. Table 3 presents results on articles that evoked one or more of the five PAAs and three KNs of the ESD program. We did not attempt a rigid demarcation between all PAAs and KNs as we deemed it to be neither feasible nor advisable, as they also possess overlapping elements. For example, the PAA Empowering and mobilizing youth and the KN Transformative action (Individual Transformation) are highly correlated. While the first one seeks to “Create opportunities for young people to empower each other” and “Reach out to connect, mobilize (*sic.*) and engage young people toward increasing their participation in sustainable development action” (UNESCO, 2020, 32), the second one fosters a combination of some stages of transformation: acquisition of knowledge and information; critical analysis; experiential exposure; empathy & compassion and empowerment (UNESCO, 2020).

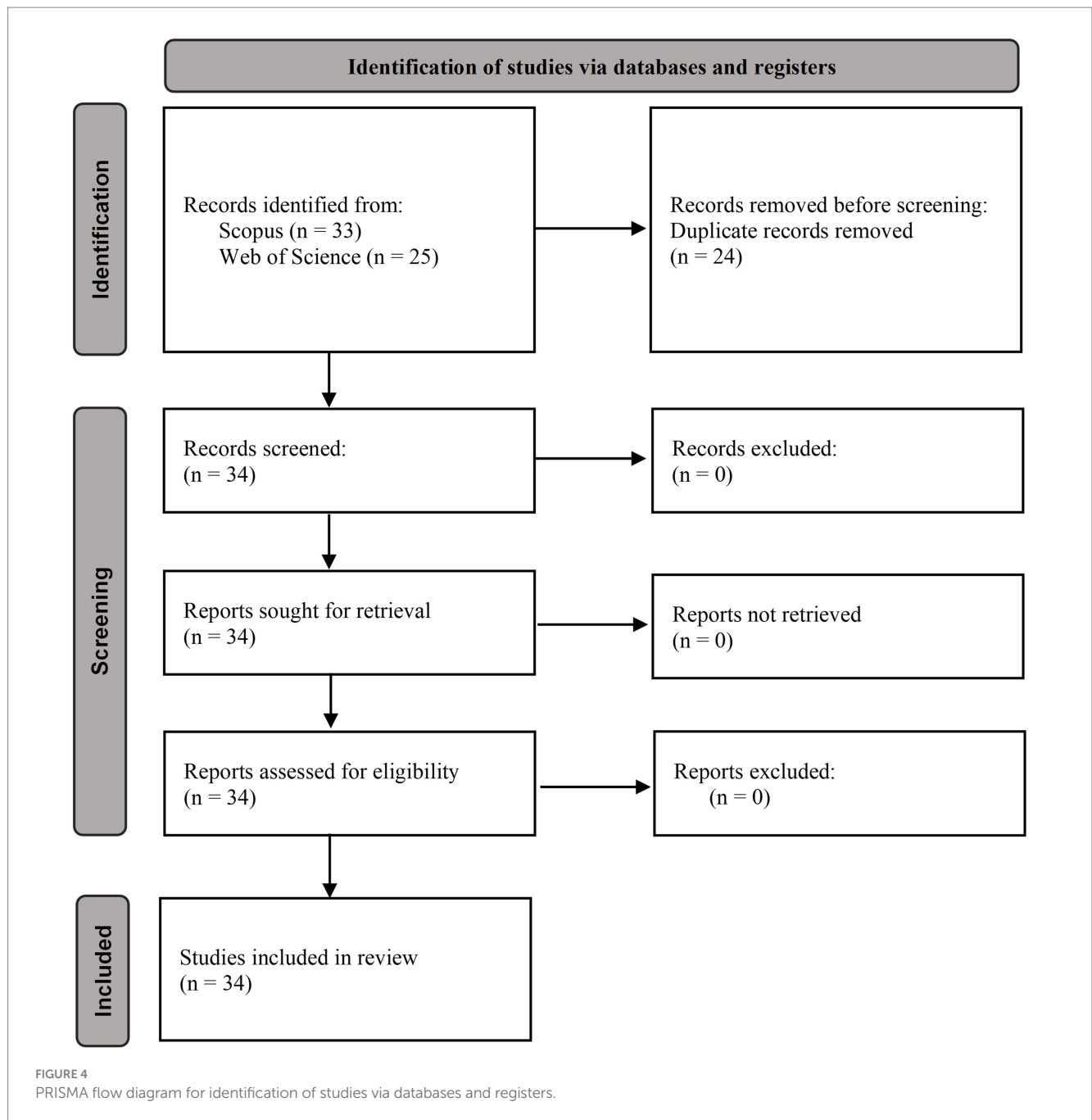
SDGs and national missions are covered, but the Global Action Programme is poorly addressed. Issues like unsustainable consumption patterns (Barth et al., 2014) tied to SDG12, the COVID-19 health crisis (Asenjo et al., 2021) primarily associated with SDG3, and the carbon dioxide emissions in urban areas (Biberhofer and Rammel, 2017) connected to SDG11 and SDG13, exemplify specific sustainability challenges. Besides the SDGs, the DESD of UNESCO is addressed as a policy vision (Cebrián et al., 2021). No direct reference to the Global Action Programme was found. Specific national spaces of deliberation have the potential to influence the adoption of improved pedagogical strategies. The Conference for the Rectors of Universities in Spain (CRUE, in Spanish) (Cebrián et al., 2021) and the Deutsche UNESCO-Kommission e.V in Germany (Hilger and Keil, 2022) serve as cases in point.

4.2 Rationale of SL

The dominant regimes in the HEI system are marked by traditional lecture-centric approaches in higher education that fall short of achieving important goals like civic engagement and nurturing global citizens (Love et al., 2021). For example, in a region, universities may be simply delivering employability or servicing the business-as-usual economy (Blewitt, 2010), or the curriculum may not be giving opportunities for students to understand the world, identify its problems and address them individually and collectively (Fals-Borda, 1987; Nussbaum, 2014; Deeley, 2016). Teachers and management staff may have minor or no interest in sustainability, or teaching staff may need training or additional materials to teach about sustainability. Students may also be solely interested in getting a high-paid job rather than making the world better due to social expectations. The job prospects for those interested in promoting sustainability might be more constricted in a community. Thus, higher education has not yet fully integrate sustainability issues through a holistic, inter, and transdisciplinary approach, despite the DESD call to do so (Molderez and Fonseca, 2018).

In such a system, SL as a niche innovation can transform the existing HEI dominant regime characteristics through the integration of the following novel roles or practices:

- HEIs become living labs for experimenting on sustainability issues (e.g., greening the campus), going beyond their traditional mandate (Deleye et al., 2019).
- HEIs connect students with the community to create positive change through interdisciplinary collaborations and interactions with non-academic stakeholders (Helicke, 2014).
- HEIs provide opportunities for students to apply classroom knowledge and develop leadership skills to serve the community in real-life settings (Ferdiansyah et al., 2022) and grant students academic credits for actively participating in community projects (Tejedor et al., 2019; Preradović et al., 2022)
- HEIs promote understanding sustainability issues as multi-layered, complex and value-based issues, and create capabilities in civic



values, community partnership, and social change, all aimed at cultivating higher levels of civic engagement (O’Flaherty et al., 2011).

- HEIs replace the traditional teacher-student hierarchy with students being involved as equal partners in both discussions and research projects (Deleye et al., 2019).

Note that these transformations in the present HEI dominant regimes require investment in all the priority action areas. Finally, SL is not viewed as a standalone initiative but as an integral component of a broader endeavor to transform universities into more responsible institutions. In this sense, SL is associated with University Social Responsibility (USR) (Cabedo et al., 2018). SL is also recognized as a science-society interface as it bridges the gap between the academic realm and the community or real-world, seeking interventions to address problems while educating students (Biberhofer and Rammel, 2017). SL also fulfills the learning

mandate for students, as learning is most effective when it is transdisciplinary, intertwined with real-world issues, and the knowledge possessed by communities regarding sustainability (Barth et al., 2014; Van Wynsberghe, 2015).

4.3 SL as carrier of ESD

4.3.1 Drivers of integration of SL in university curriculum

4.3.1.1 Policy

Cebrián et al. (2021) illustrate the influence of the Spanish Ministry of Education on a university’s strategy in Spain, showing that policies stemming from landscape pressures can create opportunities for SL

TABLE 2 Criteria for noting association with UNESCO’s PAAs and KNs.

Cluster	Element	Criteria
Priority action areas	Advancing Policy	<ul style="list-style-type: none"> Develop policies to systematically strengthen synergetic relationships between formal, non-formal and informal education and learning. Integrate ESD into all policies that explicitly address the achievement of the SDGs
	Transforming learning environments	<ul style="list-style-type: none"> Engage the local community as a valuable setting for interdisciplinary, project-based learning and action for sustainability. Create enabling environments for educators to integrate the whole institution approach on ESD (e.g., placing emphasis on ESD among other competing priorities, allowing more flexibility, facilitating partnership).
	Building capacities of educators	<ul style="list-style-type: none"> Include systematic and comprehensive ESD capacity development in pre-service and in-service training and assessment of teachers. Be facilitators who guide learners through the transformation (employ innovative pedagogies to empower learners to become change agents).
	Empowering and mobilizing youth	<ul style="list-style-type: none"> Create opportunities for young people to empower each other. Reach out to connect, mobilize and engage young people toward increasing their participation in sustainable development action.
	Accelerating local level actions	<ul style="list-style-type: none"> Provide capacity development for local decision-makers and opinion leaders as well as for the wider public. Formal and non-formal education providers in the community should coordinate their programs so that together they address all SDGs and related local sustainability challenges in a coherent way.
Key notions	Transformative action (Individual Transformation)	<ul style="list-style-type: none"> Fosters a combination of some stages of transformation: <ul style="list-style-type: none"> Acquisition of knowledge and information; Critical analysis; Experiential exposure; Empathy & comparison; Empowerment. Opens spaces to experiment with new “disruptive ideas.” Promotes intergenerational lifelong learning taking place in the community. Implements strategies also outside the school environment.
	Structural changes (Societal Transformation)	<ul style="list-style-type: none"> Questions the relationship between economic growth and sustainable development. Encourages to engage in political process or advocacy (e.g., for better regulations). Contextualizes the approaches to the realities of target populations.
	The technological future (Technological advances)	Fosters a critical perspective on the continuing relevance of ‘traditional’ sustainability values.

innovations to a certain extent. The Ministry’s Strategy for 2015 highlights the importance of social engagement and the improvement of universities’ capacity to aid the country’s social needs, advocating for the “development of a university programme that meets the values of quality and adequacy to the social context” (Cebrián et al., 2021, 491).

4.3.1.2 Integration of SL in teacher training

SL is frequently used as a didactic strategy in the field of teacher education at the undergraduate and postgraduate levels (Expósito, 2017; Asenjo et al., 2021; Hilger and Keil, 2022; Martín-Sánchez et al., 2022). This is a positive example of how HEI impact other levels of the education system, as these university students are likely to apply SL in schools in the future when they become teachers. SL was reported to have helped to show them that as aspiring teachers, they will be able to foster attitudes toward sustainability among their students (Expósito, 2017) and is seen as a way to successfully integrate the goals of sustainability into the education system (Cebrián et al., 2021).

4.3.1.3 Demand from educators for ESD/SL training

Teachers feel a need to “contribute to the training of professionals, specifically teachers, who in turn are committed to

contributing to a more sustainable and socially just world” (Asenjo et al., 2021, 9) and “to adapt to new and unforeseen needs” (Arnold, 2021, 112). Many university educators themselves tend to consider sustainability important in higher education (Busquets et al., 2021) and are starting to appreciate the manifold advantages of “a hands-on approach to learning” (Riley et al., 2007, 176). They recognize in SL a strategy that aligns with the interests and motivations of students, enabling them to attain meaningful learning (Martín-Sánchez et al., 2022). Due to this bottom-up demand, capacities of educators are being built.

4.3.2 Pathways of impact

The following are some of the most salient ways SL contributes to the key notions of ESD.

4.3.2.1 Behavioral change

Educators report the use of SL to design learning settings to foster sustainable consumption within the university (Barth et al., 2014), to promote greater autonomy in eating for individuals with severe mobility limitations (Cabedo et al., 2018).

TABLE 3 Number of articles addressing UNESCO's priority action areas and key notions.

	PAA or KN	# Hits
PAAs	Advancing Policy	6
	Transforming learning environments	29
	Building capacities of educators	31
	Empowering and mobilizing youth	33
	Accelerating local level actions	32
KNs	Transformative action (Individual Transformation)	31
	Structural changes (Societal Transformation)	31
	The technological future (Technological advances)	5

4.3.2.2 Well-being

Students express satisfaction upon realizing their own transformative potential (Expósito, 2017). Students feel rewarded by helping other people through their real-world projects (Kim, 2023). SL builds emotional involvement by bringing students closer to real-world problems, developing their critical perspective on the problems and to see their actual impact, and recognizing the immediate importance of acting to solve them.

4.3.2.3 Attitudes

According to Asenjo et al. (2021), their findings demonstrate that SLs pedagogical practices are linked to fostering pro-social attitudes among both teachers and students. In a different case, by engaging them in the real analysis of urban sustainability, “one student reported that tree surveying helped her to consider the absence of trees in urban areas” (Helicke, 2014, 298), exemplifying the development of a more positive attitude toward nature. Expósito (2017) report that a significant achievement of their SL work was the satisfaction many students experienced upon becoming aware of their own power of transformation. This aligns with the findings of Kawabe et al. (2013), who discovered that SL serves as a potent method for enhancing students’ civic engagement.

4.3.2.4 Competences

Students appreciate that SL builds competences that go beyond mastery of a body of knowledge (Arnold, 2021, 109). As one student who participated in an SL project commented: “normally the focus of the subjects is quite theoretical, and that is why I really liked the SL activity: because we have identified the problems and we have collectively discussed the possible solutions” (Expósito, 2017, 147).

4.3.2.5 Transformative action on students, teachers, and citizens

SL enhances discipline-specific learning and fosters students’ civic responsibility and teamwork skills, benefiting both the community partner and faculty members leading the projects (Kim, 2023). Gardening projects with school students (Cebrián et al., 2021) and co-creation of sustainable business model ideas for a cooperative (Hoveskog et al., 2018), among others, empower students to become change agents.

4.3.2.6 Structural change

In the Learning City initiative, a real-world urban sustainability problem was addressed in a project for each version of the program,

such as the need to strengthen greenways and promote sustainable mobility via “multi-use corridor for pedestrians, cyclists, wheelchair users, skateboarders, and in-line skaters” (Van Wynsberghe, 2015, 321). Helicke (2014) highlights how the product of an SL project influenced an urban forest master plan in the city of Saratoga Springs, in the United States. In this case, “students organized a community forum, wrote articles for the organization’s website and in local newspaper, assessed alternative fleets and fuels, and compared city plans to help prepare a local climate action plan” (Helicke, 2014, 298). These are examples of how SL addresses the NK of Structural Changes by encouraging students to engage in political processes or advocacy, as shown in Table 2.

4.3.3 Drivers of impact of SL

4.3.3.1 University-based projects

SL can also *Transform learning environments* through university-based projects, which work as a living laboratory accelerating changes toward sustainability in the university (Barth et al., 2014). Clark and Capps (2020) also provide an example of on-campus sustainability projects where three-to five-person student teams work with on-campus clients throughout the semester, researching client-posed questions and providing recommendations. This invites the reflection that a community can be defined and found at very different levels and scales.

4.3.3.2 Projects that have an immediate and visible impact

Sánchez-Carracedo and López (2021) illustrate a compelling instance of SLs tangible and immediate impact. Students participate in a Reuse Workshop, where they repair and refurbish donated computers, which are then donated to social entities, such as NGOs, schools, and other non-profit organizations, both locally and in countries in the Global South. This computers-reuse program demonstrates positive transformations in fostering students’ professional and sustainability competences while significantly reducing electronic waste and providing valuable assistance to various NGOs.

4.3.3.3 Projects that address real local problems and involve the community

Real-world learning opportunities can contribute to the effects of university ESD on social sustainability by exposing students to real-world problems in practical settings, thereby enhancing students’ understanding of sustainability issues,

improving their problem-solving skills, and providing hands-on experience in applying knowledge for sustainability (Rey-García and Mato-Santiso, 2020). Solutions are not created in isolation in the university and delivered as a service to the community; instead, they are developed based on the interaction with the experience and knowledge of community members (Barth et al., 2014). Community forums are mentioned by Van Wynsberghe (2015), Montiel et al. (2021) as a means to include policymakers as partners. Such community initiatives also *Accelerate local level actions*. SL also addresses UNESCO's Structural changes by inquiring about the possibilities for sustainable development in contexts of extreme poverty and tailoring approaches to align with the realities of target populations (UNESCO, 2020).

4.3.3.4 Motivated teachers

The intention of professors and their contacts with community partners is deemed relevant (Cabedo et al., 2018; Kim, 2023). The case illustrated by Kim (2023) is particularly noteworthy for underscoring the influence of educators' personal drive and connections in involving students in SL projects. The professor maintained a close relationship with Ten Thousand Villages (TTV), a US-based fair-trade social enterprise that markets handcrafted products from disadvantaged artisan groups in over 35 developing countries, with which she had already developed projects. Given her established collaborations with TTV, she was aware of their needs and had identified how university resources and expertise could contribute to fulfilling them, and she also knew that TTV would be a suitable choice for an SL project due to its comprehensive coverage of the product development process. Thus, students of the Master's Program of Global Product Development were tasked with the creation of innovative sustainable products for this social enterprise (Kim, 2023).

4.3.3.5 Inter-institutional collaboration

Cooperation mechanisms between institutions and external funding initiatives increase the possibility of applying pedagogical strategies such as SL in universities. Examples of collaboration included those between the Chemnitz University of Technology and Mittweida University of Applied Sciences (Arnold, 2021), the BINK project gathering six HEIs in Barth et al. (2014), Vienna University of Economics and Business, University of Natural Resources and Life Sciences, University of Vienna, Vienna University of Technology in the case of Biberhofer and Rammel (2017), the EDINSOST project bringing together twenty-seven Spanish universities in Busquets et al. (2021); Sánchez-Carracedo and López (2021); Tejedor et al. (2019), the action research project Green Innovation in Hoveskog et al. (2018), RURASL in Preradović et al. (2022) and the Learning City project Van Wynsberghe (2015).

4.3.4 Obstructors of impact of SL

Two major challenges faced in SL projects are *insufficient human capacities* and *difficulties in securing funding*, both of which impede the development and implementation of new SL initiatives (Preradović et al., 2022). Intensive sustainability courses incorporating SL experiences often demand more instructional resources than traditional lecture courses (Dvorak et al., 2011). A third challenge is the *attitude of educators*. For example, engineering educators in Brazil feel that using SL to benefit the local community for educational

purposes might not be the responsibility of engineering. They argue that while the benefits of SL mentioned in the literature are not in question, the responsibility of engineering courses to facilitate this connection can be a subject of debate (Rampasso et al., 2020).

5 Discussion

The literature review confirms that SL can be a carrier of ESD, and investments in priority action areas will generate positive externalities between their outcomes. SL is most effective when the teachers are motivated, and the learning opportunity provided is transdisciplinary, addressing local problems while involving the community. A paragraph extracted from one of the reviewed articles clearly explains how SL as a niche innovation can transform the existing dominant HEI regimes while touching upon all PAAs and KNs to serve the goals of ESD:

“By working collaboratively with community partners [PAAs *Community and Learning Environment*] to identify local needs and to co-define project goals and methods [KN *Structural changes*], faculty members can expose their students [PAA *Educators*] to diverse sensitivities, disciplines, and worldviews, thereby aiding them in attaining a deeper appreciation for their impact [KN *Transformative action and PAA Youth*] as engineers.” (Riley et al., 2007, 191).

The term *engineers* can be replaced with *professionals* for generalization purposes. No negative externality was noted in the literature.

In terms of the larger debates on sustainability transitions, SL is a tool to challenge the premise of endless economic growth and the profit/performance maximization focus of organizations: It is a suitable strategy to question to what extent economic growth and sustainable development are both possible. SL also addresses the tension between economic growth and sustainability in organizations. For example, the traditional business canvas (a business planning tool) can be replaced by a flourishing business canvas that emphasizes social and environmental goals, incorporating the concept of flourishing, which considers not only stakeholders' financial interests but also their social and environmental concerns (Hoveskog et al., 2018). This of course triggers epistemological challenges in fields like marketing (Kemper et al., 2019).

Although the literature review confirms that integration of SL is viable and a good pathway to attaining ESD goals, there is still more that can be done. To this end, we propose the following improvements.

5.1 Refine and develop SL as a pedagogy

Although SL is regarded as a real-world learning strategy, it is not the only one: faculty and staff can incorporate various models, such as project- and problem-based learning and internships, to integrate real-world learning opportunities into sustainability programs (Brundierts et al., 2010; Tejedor et al., 2019). SL is commonly employed in conjunction with Problem-Based Learning (PBL) (Expósito, 2017;

Cabedo et al., 2018; Kim, 2023). The concept of High Impact-Practices (HIP) echoes a comparable perspective on SL, emphasizing that their combined implementation yields a more significant impact than when used individually in a course (Love et al., 2021).

5.2 Gather more evidence and measure impact

Despite the imperative of measuring the impact of educational strategies to assess and enhance their efficacy, the success of SL programs is rarely discussed comprehensively with concrete numbers and indicators. Evidence of impact on action-related competences is quite sparse (Cebrián et al., 2021). Targets usually refer to a better performance of students (more knowledge acquired, for instance), but there is a need to explore the impact on sustainability competences, especially those with an action orientation that would be expected to be strengthened because of an increased civic engagement in more detail. The obstructors outlined in Section 4.3.4. are interconnected and might be associated with the insufficient impact evaluation. Since impact evaluation requires specific knowledge about what to measure (particularly in terms of sustainability competences) and how to measure, the knowledge and capabilities of the evaluators will affect the assessment of SL impact. This is closely tied to the attitudes of educators, who may find it challenging to identify which sustainability competences can be assessed, and thus may respond reluctantly to this new and unknown task, especially if they are already burdened with other non-teaching activities and are not incentivized for pedagogical experimentation. Furthermore, funding difficulties directly impede impact evaluation, as the collection and analysis of data is a time-consuming task, especially if the assessment includes qualitative and longitudinal approaches, as should be the case. Molderez and Fonseca (2018) applied an interesting approach to analyze the efficacy SL projects in HEIs to foster competences for sustainable development (). They analyzed the level of namely interpersonal, systems-thinking, anticipatory, normative and strategic competences. However, they recognize that a major limitation of their research is the absence of a pre-test. Martín-Sánchez et al. (2022) apply a pre-and post-test methodology on student-teachers to test the effectiveness of teaching practices, but they were not focused on development of sustainability competencies. In sum, although the impact definitely seems to be positive, further exploration is required to try to isolate the impact of the pedagogical approach (Dvorak et al., 2011). Additionally, while there was not a single case explicitly identified as a failure, the impact was not always similar. Indeed, Hilger and Keil (2022, 427) conclude that these projects “can oscillate along the spectrum between ‘nice try’ and ‘valuable initiative.’”

5.3 Understand and make use of technology better

Rapid advancements in modern technology have led to a growing demand for information and communication technology

(ICT) products and that their production necessitates substantial amounts of raw materials, including base metals, precious metals, and rare-earth elements, along with considerable energy consumption, resulting in greenhouse gas emissions. Thus, SL projects in HEIs can be applied to the technology field, treating it as a sustainability issue to be addressed, as shown by Sánchez-Carracedo and López (2021), who developed a computers reuse program following the SL principles.

Digital SL is proposed to offer a more extensive reach with the potential to impact global communities. The incorporation of SL into the digital realm creates opportunities to address digital citizenship and global responsibility, both of which are increasingly crucial aspects of civic life (Perkiss et al., 2020). Digital SL can circumvent some common obstacles related to finding opportunities for students to contribute to local communities, but it also comes with its own set of limitations, including issues with connectivity or Internet access, as well as students’ need for support and guidance in the online space (Perkiss et al., 2020).

5.4 Increased research within the global south

SL experiences and analyses primarily originate from the Global North, with Spain (11) being the most frequently reported country, followed by the USA (6) and Germany (3). Other countries contributing to SL experiences and analysis include Austria, Belgium, Brazil, Canada, Croatia, India, Indonesia, Ireland, Japan, and Sweden. Additionally, there were cases where the analysis involved a combination of countries: one covered the USA and Costa Rica, another included Australia, Germany, South Korea, Colombia, and Scotland, and one more focuses on Australasia, Europe, and North America. In terms of disciplines, SL has been implemented across business, economics, teacher education, urbanism, geography, political ecology, and engineering. Collectively, the present analysis strongly underscores the importance of conducting SL research in the Global South with interdisciplinary approaches.

6 Conclusion

UNESCO’s agenda for ESD posits that to tip the balance toward sustainability transitions, education must focus on sustainability not only via content, but also through novel and effective pedagogical strategies. An examination of UN documents and the academic literature confirms that SL has the potential to help the HEI system transition toward ESD. However, the ESD agenda will advance significantly only if HEIs support a wider implementation of SL projects (or other closely related pedagogical strategies). While SL is not a silver bullet, it has the potential to transform both our cultural and ecological realities. SL can effectuate both internal transformation within HEIs and external transformation that addresses present societal problems.

The systematic review of the literature on SL reveals that it is mostly theoretical and centered on the Global North. While SL

programs align with the majority of the UNESCO framework components, HEIs are finding it challenging to implement them. Educators play a pivotal role in the implementation and unless they are trained and incentivized and this is systematized, not only SL but ESD may fail to transform learning environments. The three major challenges are insufficient educator capacity, funding, and educator attitudes. These can be addressed through university-based projects addressing local problems that have a visible impact, as well as collaboration with local communities, other institutions, and social enterprises.

Future research endeavors can explore at least six avenues that remained beyond the scope of the present article. For instance, grey literature and informal reports about SL initiatives can be examined. While prioritizing peer-reviewed literature is essential, it could also be interesting to comprehensively map SL initiatives and examine them in the light of the criteria used in this research. Then, it may be worthwhile to look more deeply into the relationships between the different characteristics of HEIs such as resources, governance, management styles, internal protocols etc. and the success of ESD integration. Moving forward, there is also an enormous need for reflection on practical strategies for overcoming the identified challenges in SL implementation within HEIs. This could involve exploring innovative training programs for educators, sustainable funding models, and strategies to enhance educator attitudes toward SL and ESD. Additionally, research could focus on developing frameworks for assessing the impact of SL on both internal institutional culture and external community development. Comparative studies across diverse global contexts could offer valuable insights into tailoring SL approaches to different cultural and educational settings. Finally, a more robust understanding of the practicalities of SL implementation and its long-term effects will contribute significantly to advancing the broader goals of ESD within the HEIs landscape.

References

- Arnold, M. G. (2021). Sustainability service learning in economics. *J. Int. Educ. Bus.* 15, 106–125. doi: 10.1108/JIEB-03-2021-0040
- Asenjo, J. T., Santaolalla, E., and Urosa, B. (2021). The impact of service learning in the development of student teachers' socio-educational commitment. *Sustainability* 13:11445. doi: 10.3390/su132011445
- Barth, M., Adomßent, M., Fischer, D., Richter, S., and Rieckmann, M. (2014). Learning to change universities from within: a service-learning perspective on promoting sustainable consumption in higher education. *J. Clean. Prod.* 62, 72–81. doi: 10.1016/j.jclepro.2013.04.006
- Barth, M., and Michelsen, G. (2013). Learning for change: an educational contribution to sustainability science. *Sustain. Sci.* 8, 103–119. doi: 10.1007/s11625-012-0181-5
- Barth, M., Michelsen, G., Rieckmann, M., and Thomas, I. (2016). *Routledge handbook of higher education for sustainable development*. London: Routledge.
- Beatriz, R. G. (2014). *Reflexiones Sobre Educación, Ética y Política*. Guadalajara: Fondo Editorial Universidad Eafit.
- Beka, A. (2015). The Kosovo education for sustainable Development's role in promoting the decade of education for sustainable development in Kosovo. *Appl. Environ. Educ. Commun.* 14, 126–131. doi: 10.1080/1533015X.2015.1031411
- Betancur, Cayetano. (2009). *Filosofía de la educación. 1st Edn*. Medellín: Fondo Editorial Universidad EAFIT.
- Biberhofer, P., and Rammel, C. (2017). Transdisciplinary learning and teaching as answers to urban sustainability challenges. *Int. J. Sustain. High. Educ.* 18, 63–83. doi: 10.1108/IJSHE-04-2015-0078
- Bina, O., Balula, L., Varanda, M., and Fokdal, J. (2016). Urban studies and the challenge of embedding sustainability: a review of international master Programs. *J. Clean. Prod.* 137, 330–346. doi: 10.1016/j.jclepro.2016.07.034
- Blewitt, J. (2010). Higher education for a sustainable world. *Educ. Train.* 52, 477–488. doi: 10.1108/00400911011068432
- Bingle, R. G., and Hatcher, J. A. (1996). Implementing service learning in higher education. *J. High. Educ.* 67, 221–239. doi: 10.2307/2943981
- Bormann, I., and Nickel, J. (2017). How education for sustainable development is implemented in Germany: looking through the lens of educational governance theory. *Int. Rev. Educ.* 63, 793–809. doi: 10.1007/s11159-017-9683-9
- Brundiers, K., Barth, M., Cebrián, G., Cohen, M., Diaz, L., Doucette-Remington, S., et al. (2021). Key competencies in sustainability in higher education—toward an agreed-upon reference framework. *Sustain. Sci.* 16, 13–29. doi: 10.1007/s11625-020-00838-2
- Brundiers, K., Wiek, A., and Redman, C. L. (2010). Real-world learning opportunities in sustainability: from classroom into the real world. *Int. J. Sustain. High. Educ.* 11, 308–324. doi: 10.1108/14676371011077540
- Busquets, P., Segalas, J., Gomera, A., Antúnez, M., Ruiz-Morales, J., Albareda-Tiana, S., et al. (2021). Sustainability education in the Spanish higher education system: faculty practice, concerns and needs. *Sustainability* 13:8389. doi: 10.3390/su13158389
- Cabedo, L., Royo, M., Moliner, L., and Guraya, T. (2018). University social responsibility towards engineering undergraduates: the effect of methodology on a service-learning experience. *Sustainability* 10:1823. doi: 10.3390/su10061823
- Cars, M., and West, E. E. (2015). Education for sustainable society: attainments and good practices in Sweden during the United Nations decade for education for sustainable development (UNDESD). *Environ. Dev. Sustain.* 17, 1–21. doi: 10.1007/s10668-014-9537-6
- Cebrián, G., Moraleda, Á., Fernández, M., Fuertes, M. T., Segalás, J., and Blanco, I. G. (2021). Multiple case-study analysis of service-learning as a means to Foster sustainability competencies amongst pre-service educators. *Teachers and Teaching* 27, 488–505. doi: 10.1080/13540602.2021.1977269

Author contributions

AA-V: Writing – original draft. SR: Conceptualization, Methodology, Writing – original draft. LV: Writing – review and editing, Writing – original draft.

Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

Acknowledgments

The authors would like to thank the editor and the anonymous referees for their very insightful comments which served to greatly improve the quality of the paper.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

- Clark, C. R., and Capps, T. M. (2020). Synergy of the (campus) commons: integrating campus-based team projects in an introductory sustainability course. *Sustainability* 12:1224. doi: 10.3390/su12031224
- Colombo, C., Alves, A., Moreira, F., and van Hattum-Janssen, N. (2015). A study on impact of the UN decade of education for sustainable development on industrial engineering education. *Dirección y Organización* 56, 4–9. doi: 10.37610/dyo.v0i56.469
- Deeley, Susan J. (2016). *El aprendizaje-servicio en educación superior: teoría y perspectiva crítica*. Madrid: Narcea Ediciones.
- Deleye, M., Van, P. K., and Block, T. (2019). Lock-ins and opportunities for sustainability transition: a multi-level analysis of the Flemish higher education system. *Int. J. Sustain. High. Educ.* 20, 1109–1124. doi: 10.1108/IJSHE-09-2018-0160
- Dlouha, J., Henderson, L., Kapitulčinová, D., and Mader, C. (2018). Sustainability-oriented higher education networks: characteristics and achievements in the context of the UN DESD. *J. Clean. Prod.* 172, 4263–4276. doi: 10.1016/j.jclepro.2017.07.239
- Dvorak, B. I., Stewart, B. A., Hosni, A. A., Hawkey, S. A., and Nelsen, V. (2011). Intensive environmental sustainability education: long-term impacts on workplace behavior. *J. Prof. Issues Eng. Educ. Pract.* 137, 113–120. doi: 10.1061/(ASCE)EL1943-5541.0000054
- Eilam, E., and Trop, T. (2010). ESD pedagogy: a guide for the perplexed. *J. Environ. Educ.* 42, 43–64. doi: 10.1080/00958961003674665
- Evans, T. L. (2019). Competencies and pedagogies for sustainability education: a roadmap for sustainability studies program development in colleges and universities. *Sustainability* 11:5526. doi: 10.3390/su11195526
- Expósito, L. M. C., and de Ciurana, A. M. G. (2017). Avanzar en la educación para la sostenibilidad. Combinación de metodologías para trabajar el pensamiento crítico y autónomo, la reflexión y la capacidad de transformación del sistema. *Revista Iberoamericana de Educación* 73, 131–154. doi: 10.35362/rie730295
- Fals-Borda, O. (1987). The application of participatory action-research in Latin America. *Int. Sociol.* 2, 329–347. doi: 10.1177/026858098700200401
- Farinha, C. S., Azeiteiro, U., and Caeiro, S. S. (2018). Education for sustainable development in Portuguese universities. *Int. J. Sustain. High. Educ.* 19, 912–941. doi: 10.1108/IJSHE-09-2017-0168
- Ferdiansyah, S., Winarno, A., and Ardhita, Z. (2022). Service learning in Indonesia: developing undergraduate students' leadership during COVID-19 pandemic. *Higher Educ Skills Work Based Learn.* 12, 884–899. doi: 10.1108/HESWBL-06-2021-0123
- Filho, L., Walter, L. L., Brandli, D. B., Skanavis, C., Kounani, A., Sardi, C., et al. (2018). Sustainable development policies as indicators and pre-conditions for sustainability efforts at universities: fact or fiction? *Int. J. Sustain. High. Educ.* 19, 85–113. doi: 10.1108/IJSHE-01-2017-0002
- Filho, L., Walter, V. R., Vargas, A. L., Salvia, L. L., Brandli, E. P., Klavins, M., et al. (2019). The role of higher education institutions in sustainability initiatives at the local level. *J. Clean. Prod.* 233, 1004–1015. doi: 10.1016/j.jclepro.2019.06.059
- Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. *Research Policy* 31, 1257–1274. doi: 10.1016/S0048-7333(02)00062-8
- Geels, F. W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Res. Policy Special Section Innov. Sustain. Trans.* 39, 495–510. doi: 10.1016/j.respol.2010.01.022
- Geels, F. W., and Schot, J. (2007). Typology of sociotechnical transition pathways. *Res. Policy* 36, 399–417. doi: 10.1016/j.respol.2007.01.003
- Global Education Monitoring Report. (2016). *Education for people and planet: Creating sustainable futures for all. Second edition. Global education monitoring report 2016*. Paris: Unesco.
- Gough, D., Oliver, S., and Thomas, J. (2017). *An introduction to systematic reviews. 2nd Edn*. Los Angeles: SAGE, 23, 95–96.
- Helicke, N. A. (2014). Learning and promoting urban sustainability: environmental service learning in an undergraduate environmental studies curriculum. *J. Environ. Stud. Sci.* 4, 294–300. doi: 10.1007/s13412-014-0194-8
- Hilger, A., and Keil, A. (2022). Education for sustainable development with transdisciplinary-oriented courses-experiences and recommendations for future collaborations in higher education teaching. *J. Geogr. High. Educ.* 46, 426–446. doi: 10.1080/03098265.2021.1946765
- Hoveskog, M., Halila, F., Mattsson, M., Upward, A., and Karlsson, N. (2018). Education for sustainable development: business modelling for flourishing. *J. Clean. Prod.* 172, 4383–4396. doi: 10.1016/j.jclepro.2017.04.112
- Huckle, J., and Wals, A. E. J. (2015). The UN decade of education for sustainable development: business as usual in the end. *Environ. Educ. Res.* 21, 491–505. doi: 10.1080/13504622.2015.1011084
- Kawabe, M., Kohno, H., Ishimaru, T., and Baba, O. (2013). A university-hosted program in pursuit of coastal sustainability: the case of Tokyo Bay. *Sustainability* 5, 3819–3838. doi: 10.3390/su5093819
- Kemper, J. A., Ballantine, P. W., and Hall, C. M. (2019). Combining the 'why' and 'how' of teaching sustainability: The case of the business school academics. *Environ. Educ. Res.* 25, 1751–1774. doi: 10.1080/13504622.2019.1667959
- Kim, E. (2023). Sustainable new product development for ten thousand villages, a fair-trade social Enterprise: empowering women and economic development through problem-based service learning. *Sustainability* 15:6452. doi: 10.3390/su15086452
- Leicht, A., Combes, B., Byun, W. J., and Agbedahin, A. V. (2018a). "From agenda 21 to target 4.7: the development of education for sustainable development" in *Issues and trends in education for sustainable development*, Alexander Leicht, Julia Heiss, won Jung Byun (Paris: UNESCO Publishing).
- Leicht, A., Heiss, J., and Byun, W. J. (2018b). "Issues and trends in education for sustainable development." (Paris: UNESCO Publishing).
- Love, H. B., Valdes-Vasquez, R., Olbina, S., Cross, J. E., and Ozbek, M. E. (2021). Is cultivating reciprocal learning the gold standard for high impact pedagogies? *Higher Educ. Res. Dev.* 41, 1136–1151. doi: 10.1080/07294360.2021.1896483
- Martín-Sánchez, A., González-Gómez, D., and Jeong, J. S. (2022). Service learning as an education for sustainable development (ESD) teaching strategy: design, implementation, and evaluation in a STEM university course. *Sustainability* 14:6965. doi: 10.3390/su14126965
- McKeown, R. (2015). What happened during the UN decade of education for sustainable development? *Appl. Environ. Educ. Commun.* 14, 67–69. doi: 10.1080/1533015X.2014.971979
- Molderez, I., and Fonseca, E. (2018). The efficacy of real-world experiences and service learning for fostering competences for sustainable development in higher education. *J. Clean. Prod.* 172, 4397–4410. doi: 10.1016/j.jclepro.2017.04.062
- Montiel, I., Mayoral, A. M., Navarro-Pedreño, J., and Maiques, S. (2021). Transforming learning spaces on a budget: action research and service-learning for co-creating sustainable spaces. *Educ. Sci.* 11:418. doi: 10.3390/educsci11080418
- Nussbaum, Martha Craven. (2014). *Sin fines de lucro. Por qué la democracia necesita de las humanidades*. Buenos Aires: Editorial Katz.
- O'Flaherty, J., Liddy, M., Tansey, L., and Roche, C. (2011). Educating engaged citizens: four projects from Ireland. *Educ. Train.* 53, 267–283. doi: 10.1108/00400911111138442
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 372:n71. doi: 10.1136/bmj.n71
- Perkiss, S., Anastasiadis, S., Bayerlein, L., Dean, B., Jun, H., Acosta, P., et al. (2020). Advancing sustainability education in business studies through digital service learning. *Am. Bus. Rev.* 23, 283–299. doi: 10.37625/abr.23.2.283-299
- Preradović, N. M., Čalić, M., and Overbeeke, P. S. M. van. (2022). Rural 3.0: a case study of university-community engagement through rural service-learning in Croatia. *J. High. Educ. Outreach Engagem.* 26.
- Rampasso, I. S., Quelhas, O. L. G., Anholon, R., Pereira, M. B., Miranda, J. D. A., and Alvarenga, W. S. (2020). Engineering education for sustainable development: evaluation criteria for Brazilian context. *Sustainability* 12:3947. doi: 10.3390/su12103947
- Rey-García, M., and Mato-Santiso, V. (2020). Enhancing the effects of university education for sustainable development on social sustainability: the role of social capital and real-world learning. *Int. J. Sustain. High. Educ.* 21, 1451–1476. doi: 10.1108/IJSHE-02-2020-0063
- Rieckmann, M. (2011). Future-oriented higher education: which key competencies should be fostered through university teaching and learning? *Futures* 44, 127–135. doi: 10.1016/j.futures.2011.09.005
- Riley, D. R., Grommes, A. V., and Thatcher, C. E. (2007). Teaching sustainability in building design and engineering. *J. Green Build.* 2, 175–195. doi: 10.3992/jgb.2.1.175
- Rip, A., and Kemp, R. (1998). "Technological change" in *Human Choice and Climate Change*. eds. S. Rayner and E. L. Malone, vol. 2 (Columbus, Ohio: Battelle Press), 327–399.
- Sánchez-Carracedo, F., and López, D. (2021). A service-learning based computers reuse program. *Sustainability* 13:7785. doi: 10.3390/su13147785
- Shulla, K., Leal Filho, W., Lardjane, S., Sommer, J. H., and Borgemeister, C. (2020). Sustainable development education in the context of the 2030 agenda for sustainable development. *Int. J. Sustain. Dev. World Ecol.* 27, 458–468. doi: 10.1080/13504509.2020.1721378
- Sidiropoulos, E. (2018). The personal context of student learning for sustainability: results of a multi-university research study. *J. Clean. Prod.* 181, 537–554. doi: 10.1016/j.jclepro.2018.01.083
- Tejedor, G., Segalàs, J., Barrón, Á., Mónica Fernández-Morilla, M., Fuertes, T., Ruiz-Morales, J., et al. (2019). Didactic strategies to promote competencies in sustainability. *Sustainability* 11:2086. doi: 10.3390/su11072086
- Uman, L. S. (2011). Systematic reviews and Meta-analyses. *J. Can. Acad. Child Adolesc. Psychiatry* 20, 57–59.

- UNESCO. (2005). "United Nations decade of education for sustainable development (2005–2014): International implementation scheme." Paris, France: United Nations Educational, Scientific and Cultural Organization.
- UNESCO. (2014). "Roadmap for implementing the global action Programme on education for sustainable development." Paris, France: United Nations Educational, Scientific and Cultural Organization.
- UNESCO. (2016). Education 2030: Incheon declaration and framework for action for the implementation of sustainable development goal 4. Paris, France: United Nations Educational, Scientific and Cultural Organization.
- UNESCO. (2020). Education for sustainable development. A roadmap. Paris, France: United Nations Educational, Scientific and Cultural Organization.
- United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. A/RES/70/1. New York, USA: United Nation General Assembly, 4th plenary meeting.
- Van Poeck, K., and Vandenaabeele, J. (2012). Learning from sustainable development: education in the light of public issues. *Environ. Educ. Res.* 18, 541–552. doi: 10.1080/13504622.2011.633162
- Van Wynsberghe, R., and Moore, J. L. (2015). UN decade on education for sustainable development (UNDESD): enabling sustainability in higher education. *Environ. Dev. Sustain.* 17, 315–330. doi: 10.1007/s10668-014-9606-x
- van't Land, H., and Herzog, F. (2017). "Higher education paving the way to sustainable development: A global perspective." International Association of Universities (IAU).
- Wals, A. E. J. (2015). "Social learning-oriented capacity-building for critical transitions towards sustainability" in *Schooling for sustainable development in Europe: Concepts, policies and educational experiences at the end of the UN decade of education for sustainable development*. (Cham: Springer International Publishing), 87–107.
- Wiek, A., Withycombe, L., and Redman, C. L. (2011). Key competencies in sustainability: a reference framework for academic program development. *Sustain. Sci.* 6, 203–218. doi: 10.1007/s11625-011-0132-6
- Wu, Y.-C. J., and Shen, J.-P. (2016). Higher education for sustainable development: a systematic review. *Int. J. Sustain. High. Educ.* 17, 633–651. doi: 10.1108/IJSHE-01-2015-0004