Article

Systematic Review of Education Sustainable Development in Higher Education Institutions

Chen Kim Lim 1,*, Martin Shafiihuna Haufiku 2, Kian Lam Tan 3, Minhaz Farid Ahmed 1 and Theam Foo Ng 4

1 Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia, Bangi 43600, Malaysia
2 Department of Computing, Faculty of Arts, Computing and Creative Industry, Universiti Pendidikan Sultan Idris, Tanjung Malim 35900, Malaysia
3 School of Digital Technology, Wawasan Open University, 54, Jalan Sultan Ahmad Shah, George Town 10050, Malaysia
4 Centre for Global Sustainability Studies (CGSS), Level 5, Hamzah Sendut Library, Universiti Sains Malaysia, George Town 11800, Malaysia
* Correspondence: kim@ukm.edu.my

Abstract: It is vital to enforce the distinguished assimilation of sustainability entities in higher education (HE) and establish an academia-wide collective curriculum on sustainability in an efficient manner, in order to disseminate and stimulate thoughts with forthcoming generations. The remit of this paper is to document the available literature and map the research landscape into a coherent taxonomy. This research adds to the available literature; moreover, it could also aid in the community comprehension of education in sustainable development (ESD) implementation and/or integration into higher education institutions (HEIs). We perform an attentive search in relation to education sustainable development (ESD) in three relevant electronic databases, namely, Web of Science (WoS), ScienceDirect and IEEE Xplore. The result of the review is a taxonomy that includes 148 articles published between early 2014 and mid-2019 that were then categorized into six classes, namely, the accomplishment of SD, awareness and commitment, evaluation and commentary, structural transformation, course coordination and university management. Additionally, we acknowledge varied involvement from different levels of communities supporting and promoting education to achieve sustainable development (SD).

Keywords: education sustainable development (ESD); sustainable development (SD); sustainable education (SE); higher education institution/s (HEIs); Sustainable Development Goals (SDGs); environmental education (EE)

1. Introduction

To ensure a better world, world leaders approved the 2030 Agenda for Sustainable Development during the United Nations Sustainable Development Summit in 2015. The objectives of this agenda are to end poverty, injustice, inequality and climate change before 2030. The three pillars of sustainable development are: (1) social, (2) environmental, and (3) economic, and each of the pillars overlap. The goals of sustainable development can only be achieved if there is a balance or exchange between the pillars.

Principally, education for sustainable development (ESD) integrates the message of sustainable development during sessions of teaching and learning, such as to stimulate and equip students to make decisions that benefit sustainability, as discussed by [1,2]. For example, ESD is able to authorize people to distinguish differences in their point of view and collaborate with others to achieve a sustainable future environment, making our world a safer place. In addition, UNESCO has urged higher education institutions (HEIs) to play their collective role, in order to achieve the targets of Sustainable Development Goals, a topic that was previously covered by [3,4]. The study of [5] stated that more...
than 1100 HEIs from 94 countries have engaged with Times Higher Education (THE) to present their contributions towards the SDGs. In addition, Ref. [6] also highlighted that many countries are committed to establishing sustainable development education. Furthermore, Ref. [7] also stated that the Chinese government integrated the 2030 Agenda for Sustainable Development into their domestic long- and mid-development strategies, such as China Education Modernization 2035. The study of [8] proposed a framework to integrate the concept of sustainable development into the chemistry curriculum in Malaysia, while [9] presented the implementation of global citizenship and impact of the Malaysian education system. In [10], it was argued that the alignment between global education systems with the 17 interlinked global goals is not clear based on existing findings.

The 17 Sustainable Development Goals (SDGs) were predominantly set up in 2015 by the United Nations General Assembly, which is also called the UN-GA. The SDGs were developed to succeed the Millennium Development Goals, which ended in 2015, the objectives of which are to produce a set of universal goals to end world poverty, injustice, inequality and climate change before 2030. In a nutshell, the SDGs are a universal call to action to shift the world onto a more sustainable path.

Recently, ESD was also integrated into the 2030 Agenda for Sustainable Development. Under the fourth Sustainable Development Goal (SDG 4) is quality education, comprising 10 targets; the main aim of target 4.7 is to permeate education at all levels (mainstreaming). In addition, the Council of the European Union also supports this action. In other words, this goal is to ensure that all children are able to complete free primary and secondary schooling by 2030 and to present equal access to affordable vocational training, as previously mentioned by [11].

The main purpose of this study is to focus on target 4.7.1 (https://sdgs.un.org/goals, accessed on 6 June 2022; https://sdgs.un.org/goals/goal4, accessed on 6 June 2022). This target outlines that all students must be able to gain the knowledge and talent to elevate sustainable development before 2030. In order to achieve this target’s goal, we all need to contribute. Furthermore, this extends to education for sustainable development (ESD) being mainstreamed at all levels in national education policies, curricula, the education of teachers and the assessment of students. Moreover, Ref. [12] analysed the preconditions to obtain students’ opinions about economic growth in the context of sustainability.

According to [13], it is necessary for higher education institutions (HEIs) to be able to integrate sustainable development as an effective way to promote and share ideas with future generations. Based on recent trends, many HEIs have started to play their role in embedding sustainable development into their academic syllabus [14]. Furthermore, Ref. [15] highlighted that HEIs have the potential to develop and expand current knowledge and information through channels of teaching and learning, community engagement, general campus operations and research as a whole, in order to educate students about sustainable development, since students are the future leaders and inheritors of technology.

The following are strategies to address the lack of investigations in SD and ESD implementation and integration:

- The holistic nature of this SD and ESD investigation produces a comprehensive review of the literature available in the top academic databases. This research adds to the available literature, and it could also aid in improving the community comprehension of ESD and/or SD implementation and/or integration into HEIs. This section provides the challenges observed from the available literature.
- There is a lack of scientific research associated with ESD and, for this reason, there are still gaps within the literature which need to be addressed [16]. Furthermore, this limited number of studies reduces the capacity of researchers to offer specific transferable insights [17]. Moreover, the lack of literature hinders the identification of Tools, Methods, Frameworks and Approaches (TMFAs) and the categorization of “people dimensions” marked, these being namely, teaching, research, campus operations, internal outreach, external outreach and cross institutional [18]. Moreover, Ref. [19] further stated that there
is a lack of information addressing the processes by which sustainability collaborations take place.

This is not the only issue, because other researchers have also found it difficult to access certain information. The studies of [20,21] stated that it was difficult to locate information through secondary sources, as it was often hidden within the academic program materials or detailed descriptions of courses.

2. Approach

Figure 1 shows the flow of the literature selection to retrieve the final dataset of studies to be reviewed. The researchers divided the systematic literature review method into a few stages, i.e., scoping, planning, identification, screening and eligibility. At the scoping level, the researchers elucidated that this research is significant for integrating sustainable development holistically in higher education institutions. During the planning stage, numerous search keywords were derived, and the inclusion and exclusion criteria were formulated by extracting the information from relevant studies.

The formulated Inclusion criteria are as follows:

1. Articles retrieved only from ScienceDirect, WoS and IEEE Xplore were considered for this study.
2. Articles issued between 1 January 2014 and 31 May 2019 were only extracted for this study.
3. Only original and review articles were extracted.
4. Only the articles that emphasized and deliberated education in sustainable development (ESD), sustainable development (SD), sustainable education (SE) and environmental education (EE) in higher education institutions (HEI) were extracted.
5. Only the articles written in English were considered for this study.

The formulated exclusion criteria are as follows:

1. Articles that emphasized and deliberated ESD, SD, SE and EE in early childhood development (ECD), specifically in junior and senior schools, were omitted.
2. Articles that emphasized and deliberated SD but were not accessible in the scholastic domain were omitted.
3. Articles that emphasized and deliberated EE but were not accessible in the domain of sustainability were omitted.

At the identification stage, the article screening was conducted with the three selected databases where all the top-ranked and quality journals are archived. Additional manually searched articles were also added to the repository of the articles extracted earlier. As illustrated in Figure 1, 459 articles were found in IEEE Xplore, 219 articles were found in ScienceDirect, 531 articles were found in WoS and 16 articles were found through a manual search. The final dataset retrieved from the three databases consisted of 1209 articles. The
process continued in the screening stage where the title and the abstract of the articles were scanned and the redundant articles were removed from the dataset based on the determining inclusion and exclusion criteria. A total of 1039 articles were removed from the earlier dataset, leaving 170 articles in the repository. At the final stage of eligibility, the researcher removed 38 articles that were not written in the English language and finally obtained 148 articles with full text, including a manually searched 16 articles in the repository. The researcher then meticulously extracted the relevant information from the 148 \((n = 148/1209; 12.24\%)\) articles.

3. Taxonomy Classification

Figure 2 shows the taxonomy derived from the selected articles in this study. Subsequent to meticulous analysis, the articles were organized into six main sections (accomplishment of sustainable development (i.e., SD) (17.57%; 26/148 articles); awareness and commitment (20.27%; 30/148 articles); evaluation and commentary (17.57%; 26/148 articles); structural transformation (7.43%; 11/148 articles); course coordination (33.11%; 49/148 articles); and university management (4.05%; 6/148 articles)). The taxonomy is derived because it can deliver the knowledge found in all the articles in a clear, easy to comprehend and usable manner. In addition, taxonomies are the most basic elements of information architecture. The main sections were then sub-categorized into subsections based on each main section. In the accomplishment of the SD section, it was sub-categorized into local studies (50.00%; 13/26 articles) and global studies (50.00%; 13/26 articles), while the awareness and commitment section was sub-categorized into three subsections: students’ awareness (36.67%; 11/30 articles); internal community awareness (30.00%; 9/30 articles); and internal and external community awareness (33.33%; 10/30 articles). The third subsection derived from the evaluation and commentary section was sustainability evaluation (19.23%; 5/26 articles); sustainability commentary (61.54%; 16/26 articles); and tool development (19.23%; 5/26 articles). The structural transformation \((n = 11\) articles) and university management \((n = six\) articles) were not sub-categorized due to inadequacy in fulfilling the requirements to further divide into a new sub-category. Finally, the course coordination section was sub-categorized into six sub-sections, namely, cross-disciplinary (12.25%; 6/49 articles); inter-disciplinary (12.25%; 6/49 articles); multi-disciplinary (6.12%; 3/49 articles); trans-disciplinary (10.20%; 5/49 articles); creation (30.61%; 15/49 articles); and other (28.57%; 14/49 articles).

It is vital to mention that outside of statistical research, reliability and validity can be used interchangeably. Using this rationale, this particular review highlighted that it is not quantitative in nature. A number of the studies were not able to conclude and/or generalize their results in the broader sense because the researchers used undersized samples to fit the scopes for these studies [22–39]. Furthermore, a few studies also acknowledged the collection of undependable, highly complex and inconclusive data [14,20,26,27,31,32,40–45]. The authors of [20,46–48] also conceded that some external factors may have affected the validity and reliability of the results of these studies. Finally, a specific model could not be considered complete, as it was still missing vital information [49].

3.1. Accomplishment of SD

A total of 26 articles concentrated on the accomplishment of SD in the HEIs scheme. These articles highlighted the evolution of sustainability in HEIs and predicted the future of ESD in HEIs: the responsibility of HEIs in carrying out SD in HEIs’ systems, dealing with the lack of profoundness concerning sustainability and HEIs, and ascertaining and classifying the significant factors as well as seeking resolutions to them. These articles further analysed the consequence of policy agreements and conferences for SD among HEIs. Two subsections were identified for further investigation whether the reach of the studies was local (thirteen articles) or global (thirteen articles). Table 1 shows the two subsections (local and global) of the first section (accomplishment of SD), and the articles under each subsection.
Figure 2. Overall taxonomy of the selected articles.

Table 1. Subsections of accomplishment of SD.

<table>
<thead>
<tr>
<th>Subsection</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local (13)</td>
<td>[31,35,49–59]</td>
</tr>
<tr>
<td>Global (13)</td>
<td>[14,18,60–70]</td>
</tr>
</tbody>
</table>

3.1.1. Local Studies

Thirteen articles are based on local studies because they deal with a country and/or countries or those that deal with a particular regional bloc but do not relate to the whole world. The study of [50] discussed the role of the Association of Southeast Asian Nations (ASEAN) universities that practise social responsibility and sustainable development. The study of [51] discussed a future centre for teacher education (ZZL-Network) at the Leuphana University of Lueneburg, Germany. The study of [52] discussed the development of university sustainability in the United States since the early 1970s. The study of [53] discussed the assumptions behind the observed practices of ESD and/or principles for responsible management education (PRME) at the University of the West of England (UWE), Bristol, United Kingdom. The study of [31] painted a broad picture of ESD in the central European region. The study of [54] conducted a pilot case by analysing several HEIs in Malaysia to investigate the hindrance to implementing sustainability in public HEIs via both academic and pragmatic perspectives. The study of [55] used focus groups during scholastic meetings and conferences related to ESD in HE (European Virtual Seminar...
(EVS) Meeting 2013, Sinaia, Romania; and Regional Centres of Expertise (RCE) Meeting 2013, Kerkrade, The Netherlands) and sustainability in HEIs (ESCR-EMSU 2013, Istanbul, Turkey), as well as at a university in Germany. The study of [55] shared Universiti Sains Malaysia’s (USM) sustainability engagement with a wider circle of practitioners to achieve the Global Action Program (GAP). The study of [56] analysed the spread of the concept of SD in Russian HE as a subsystem of the national innovation system. The study of [57] presented a pedagogical initiative based on regions for the integration of SD in HE made by two universities and five colleges in Quebec (Canada). The study of [35] analysed the degree of the implementation of sustainability practices in Spanish institutions and examined the key components that clarify sustainability practices’ implementation in their universities. The study of [58] dealt with the progression of teaching and enforcing sustainability at VSB, Technical University of Ostrava (VSB-TUO), Czech Republic. The study of [59] analysed the circumstances in Kazakhstan and the pace with which it had engaged to reorganize its education system in the context of SD.

3.1.2. Global Studies

Thirteen articles are based on global studies because these articles are related to the whole world and capture a comprehensive worldview. The study of [60] deepened the role of universities for SD by building on materials produced during the G7 Environment Ministerial Meeting held in Bologna, Italy, 11–12 June 2017. The study of [61] also analysed the importance of international conferences for the HEIs promotion of sustainability. The study of [62] presented a systematic review on the topic of sustainability in HE, typically in Portuguese-speaking countries. Similarly, Ref. [18] presented an overview of the jargon used for incorporating sustainability principles in HE, as well as the TMFAs presented to transformation agents. The study of [63] explored the link between revolution and sustainability in HE and investigated the basic obstacles to innovation and sustainable development in HEIs around the world. The study of [64] addressed the deficiency of depth and comprehensiveness by identifying and categorizing the critical attributes of sustainability in HE. The study of [65] systematically analysed the consequences of SD trends and the future directions that HEIs might take under a potential second decade (2015–2024). The study of [14] answered whether the commitment to SD (through signing a declaration, charter, or initiatives for SD) resulted in a better implementation of SD within HEIs. The study of [66] mapped and reviewed publications on sustainability in HE according to four categories (types of papers, challenges, teaching techniques and course coordination). The study of [67] embraced 33 articles that illustrated some of the struggles faced by HEIs in contributing to sustainability. The study of [68] reviewed the UN’s Decade of Education for Sustainable Development (UN DESD). The study of [69] defined how skills development provision contributes to sustainable development while encouraging social justice and zero poverty. The study of [70] reviewed the published literature on renewable energy education initiatives across the globe.

3.2. Awareness and Commitment

A total of 30 articles addressed the community, their awareness and their commitment to the unification of ESD. These articles concentrated on internal and external community awareness of ESD and/or SD approaches in HEIs, focusing on the role of the community in ESD and/or SD in HEIs. The researcher further scrutinized the aspects persuading community commitment in ESD and concentrated on the community and/or HEIs’ partnership. These were then classified accordingly into three sub-sections to explore the studies’ focus on community awareness if they were related to student awareness (11 articles), internal community awareness (nine articles), or internal and external community awareness (10 articles). Table 2 shows the three subsections (students, internal community, internal and external community) from the main section, awareness and commitment, and the articles under each subsection.
Table 2. Subsections of awareness and commitment.

<table>
<thead>
<tr>
<th>Subsection</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students (11)</td>
<td>[37,41,45,46,71–77]</td>
</tr>
<tr>
<td>Internal Community (9)</td>
<td>[24,39,78–84]</td>
</tr>
<tr>
<td>Internal and External Community (10)</td>
<td>[1,19,24,25,33,85–89]</td>
</tr>
</tbody>
</table>

3.2.1. Student Awareness

Eleven articles covered student awareness because these articles pertain to the views and observations of the student towards ESD and/or SD in HEIs. The study of [71] added an understanding of students’ perceptions toward sustainability, focusing on students in business management/marketing. The study of [72] discussed the awareness of the student on the effectiveness of learning activities in fostering sustainability competencies. The study of [46] discussed students’ awareness towards the significance of Problem-Based Learning (PBL) to embrace sustainability. The study of [41] used a generic measure that discovered how SE-impacted students learn in various disciplines, institutions and countries. The study of [73] discussed student understandings and perceptions about SE and environmental health. The study of [74] introduced a longitudinal survey of educating students about environmental embracement and its importance. The study of [75] presented a holistic approach to SE to elevate the student experience at the HEIs. The study of [76] investigated the attitudes and perceptions of a group of 32 students and teachers who were involved in educating about sustainable development competencies. The study of [77] proposed to investigate how students experienced a generic situation through a phenomenological approach, involving collaboration from the student internship organization. The study of [37] interpreted students’ awareness of how they utilize technology for their learning and the link to sustainability and employability. The study of [45] demonstrated how the notion of values can be utilized to alleviate ESD in the tertiary business education syllabus, regardless of the educator’s supervision or course assessment by observing the students.

3.2.2. Internal Community Awareness

Nine articles cover internal community awareness because they pertain to the views and observations of the professors, top management, administration personnel and service personnel towards ESD and/or SD in HEIs. The study of [24] highlighted the current relative emplacement and significance of economic aspects over others in the context of social responsibility and sustainability by using a survey that targeted two university networks. The study of [78] considered ESD to envision across culturally diverse settings around the world by surveying faculty members from different HEIs globally. The study of [79] explored the individualized attitude of academics, especially in teacher education courses and in the scholastic field of ESD on the concept of SD. The study of [80] explored the ongoing pace of teaching sustainability amongst the software engineering community, the motivations behind the ongoing pace of teaching and how to make progress in it. The study of [81] presented the evolution and discussed the implementation barriers of green ICT at HEIs based on the faculty survey conducted in India. The study of [82] identified the issues that could forecast pro-environmental behaviour in the organization using data collected from the employees of different departments of Wageningen University and Research in The Netherlands. The study of [39] explored how faculty and the workforce expressed their role in sustainability work. The study of [83] explored the issues affecting academic workforce commitment in ESD and the opinions as well as the perceptions of the academic workforce concerning ESD at the University of Southampton. The study of [84] presented an outline of the implementation of advanced SD philosophy in the policy of the Kaunas University of Technology, Lithuania, using the data collected from expert (10 employees) interviews.
3.2.3. Internal and External Community Awareness

Ten articles cover internal and/or external community awareness because they pertain to the views and observations of the internal (students, professors, top management, administration, service personnel) and the external (suppliers, communities, and local population) community towards ESD and/or SD in HEIs. Utilizing a literature review, Ref. [85] demonstrated the dynamic by which the HEIs presented the environmental management subject and located the authors who studied this theme and the HEIs that applied environmental protections. The study of [25] investigated the main community of public HEIs in Portugal to perceive the ideas of sustainability and sustainable HEIs; the responsibility of HESD; and the hindrance, limitations and complications in conducting sustainable initiatives in public HEIs in Portugal. The study of [2] discussed the mainstreaming strategy that was applied to the University of Bern, Switzerland. The study of [86] explored the field of sustainability-oriented HE partnership; analysed their key areas of interest, inter-network relationships, and links with the policymakers; and examined the situations for cooperation in joint programs and strategy development. The study of [24] presented how the revolution in learning ESD required the commitment of faculty and student. The study of [19] explored the common practices that could deliver stimulus and encouragement for the sustainability field in trans-national research and teaching. The study of [33] examined the extent to which capacity building for SD is being undertaken and suggested forms to evaluate some of the benefits for local communities. The study of [87] presented an empirical analysis of ESD concerning provincial projection. The study of [88] analysed the role that academics play in multi-community initiatives at a global level and the nature of their participation. The study of [89] discussed the roundtable reviews of the 4th UNESCO Chair Conference on HESD.

3.3. Evaluation and Commentary

A total of 26 articles deliberated how sustainability could be measured and documented in HEIs. These articles concentrated on constructing the issues and accessibility of sustainability matters in HEIs’ degree titles and courses. These articles also focused on the preparation and observation of ESD and/or SD accomplishments within as well as outside of the HEIs, especially focusing on the legitimacy and dependability of the tools. These tools are established to scrutinize pedagogy, utilize ESD in HEIs and evaluate the actions of HEIs.

Three subsections were identified for further investigation, mainly for the three main purposes of evaluation and commentary. According to [90,91], these are to assess SD (five articles), communicate sustainability efforts (sixteen articles), and develop a tool for analysis amongst universities (five articles). Table 3 shows the three sub-sections (SD evaluation, sustainability commentary and tool development) of the main section, evaluation and commentary, and the articles under each subsection.

Table 3. Subsections of evaluation and commentary.

<table>
<thead>
<tr>
<th>Subsection</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainability Evaluation (5)</td>
<td>[92,93]</td>
</tr>
<tr>
<td>Sustainability Commentary (16)</td>
<td>[16,21,22,28,40,41,94–103]</td>
</tr>
<tr>
<td>Tool Development (5)</td>
<td>[20,49,104–106]</td>
</tr>
</tbody>
</table>

3.3.1. Sustainability Evaluation

Five articles assessed ESD and/or SD for reporting the use of evaluation tools to assess ESD and/or SD in HEIs. The study of [92] analysed the core course in the top 100 HEIs in the U.S. to assess the number of main programs that highlighted climate transformation or climate science. The study of [107] also highlighted the issues affecting the SD syllabus in the courses of two HEIs. The study of [108] proposed a cohesive tool to measure the
degree of obligation and institutional partnership of HEIs in the United States to study the obstacles posed by sustainability. The study of [109], through a systematic comparison of two engineering institutions, provided an understanding of different kinds of activities and their internal as well as external enablers. The study of [93] assessed the effectiveness of ESD through e-learning in HE.

3.3.2. Sustainability Commentary

Sixteen articles communicated sustainability efforts and progress because they reported on ESD and/or SD evaluation in HEIs. The study of [22] investigated the awareness of faculty members on the potential benefits of incorporating AR technology, in terms of its economic and environmental sustainability in Saudi Arabian HEIs. The study of [28] assessed the role of online training courses in fostering sustainable human development in engineering degrees. The study of [40] presented a bibliometric analysis of educational stakeholders involved in a European initiative focusing on expanding engineering education for SD. The study of [94] analysed the process for implementing new models of commentary. The study of [16] highlighted the fundamental role of sustainability in HEIs and their development in different contexts (territorial, economic, political, social and environmental). The study of [21] presented a review of teaching and learning sustainable consumption based on competencies to achieve transdisciplinary learning. The study of [95] discussed the issues of accessing sustainability content in HEIs’ degree titles. The study of [96] discussed the visibility of sustainability in technical vocational education programmes and explored the overarching goal of ESD and its importance in technical vocational education. The study of [97] provided a short overview of sustainability in HEIs and presented the various existing evaluation approaches. The study of [98] carried out a constructive analysis of the GreenMetric Ranking to improve and strengthen the evaluation process. The study of [99] explored the role of HEI in the education of SD competence. The study of [100] developed and applied a model that considered the social, economic and environmental concerns to evaluate the science and technology institutes that contribute to the spread of sustainable practices. The study of [101] offered an all-inclusive review of the existing literature on sustainable commentary in HE. The study of [41] explained the worldwide diffusion of sustainability commentary in HEIs. The study of [102] presented a critical review of the GreenMetric World University Ranking. The study of [103] explored the current and future potential of HESD in the Republic of Serbia, drawing upon years of commitment to the national SD strategy preparation and monitoring schemes.

3.3.3. Tool Development

Five articles are used to develop a tool to analyse HEIs because they are useful for the development of a new evaluation tool. The study of [104] developed a Balanced Scorecard strategy chart for enforcing and following up on environmental academic courses in HEIs. The study of [20] discussed the possibility of exploiting an additional course file during academic assessments. The study of [105] developed a novel assessment scheme called QUESTE-SI that concentrated on assessing the institutional unit and/or institutions that are accountable for one or more courses. The study of [49] introduced and discussed the INDICARE model’s theoretical foundation, its application as well as its viewpoints on sustainability evaluation in the HEIs. The study of [106] investigated the methodology for evaluating the necessary designated training courses that could assist the HE leaders in developing the talented pool required to improvise SD.

3.4. Structural Transformation

A total of eleven articles concentrated on the changing aspects of structural transformation administration for sustainability. Moreover, these articles also emphasized determining and anticipating the issues for ESD and/or SD incorporation into HEIs, concentrated on policy execution, focused on the academic for structural transformation in administration, and matched the structural transformation in various HEIs.
3.5. Course Coordination

Six additional subsections were identified for further investigation, including cross-disciplinary (six articles); inter-disciplinary (six articles); multi-disciplinary (three articles); trans-disciplinary (five articles); sustainability-centred course or program (fifteen articles); and analysis (fourteen articles). Table 4 shows the six subsections (cross-disciplinary, inter-disciplinary, multi-disciplinary, trans-disciplinary, creation and analysis) of the main section, course coordination, and the articles under each subsection.

Table 4. Subsections of course coordination.

<table>
<thead>
<tr>
<th>Subsection</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-disciplinary (6)</td>
<td>[27,47,110–113]</td>
</tr>
<tr>
<td>Inter-disciplinary (6)</td>
<td>[114–119]</td>
</tr>
<tr>
<td>Multi-disciplinary (3)</td>
<td>[120–122]</td>
</tr>
<tr>
<td>Trans-disciplinary (5)</td>
<td>[38,48,123–125]</td>
</tr>
<tr>
<td>Creation (15)</td>
<td>[13,42,126–138]</td>
</tr>
<tr>
<td>Analysis (14)</td>
<td>[17,29,36,67,86,87,105,139–145]</td>
</tr>
</tbody>
</table>

3.5.1. Cross-Disciplinary

Six articles are cross-disciplinary because of inaccessible inculcation across the courses. The study of [110] expended the possibility of citizen science as an innovative pedagogical tool to improve the research and learning knowledge of engineering practitioners in the context of sustainability. The study of [27] explored the visual effect to raise thinking systems and to execute and practise sustainability. The study of [47] discussed sustainability consciousness as a complex of cognitive and affective learning. The study of [111] developed a methodology to reveal the required knowledge, skills and attitudes for the students to make multi-dimensional decisions suiting the sustainability experiments. The study of [112] embedded sustainability into a first-year engineering course. The authors of [113] were concerned with the necessity to educate technicians efficiently and practically by developing a practical and theoretical course for a one-year training program in renewable energies.

3.5.2. Inter-Disciplinary

Six articles are inter-disciplinary because of the consolidation of various disciplines to resolve detailed matters for sustainability that involve intricate method-sharing. The study of [114] investigated a lab-based learning atmosphere where master’s degree students engaged to support the evolution to a sustainable society. The study of [115] described the skills needed to prepare students to handle and tackle challenges in urban sustainability through an assorted academic background. The study of [116] described four capstone projects developed by students from the Erasmus Mundus Master Course in Pervasive Computing and Communications for Sustainable Development (PERCCOM). The study of [117] demonstrated the importance of adopting an interdisciplinary tactic that emphasizes sustainable development. The study of [118] harnessed the fusion between student commitment and an immersive educational approach to nurture effective communicative skills among students through web-based and flexible educational materials that enable peer knowledge transformation across learning stakeholders at varied universities to meet the challenges of sustainability. The study of [119] designed a course, the interdisciplinary study program on sustainability (ISPoS), to teach sustainability issues.
3.5.3. Multi-Disciplinary

Three articles are multi-disciplinary because different fields of knowledge are coupled to educate about sustainability, with each discipline retaining its technique. Moreover, each discipline is answerable for a different topic related to sustainability. The study of [120] discussed why the awareness of interconnectedness and pedagogical approaches are crucial in promoting sustainability. The study of [121] described a multidisciplinary graduate course on solar energy for science, engineering, economics and management students that focused on nurturing professionals to be capable of understanding and developing solar energy. The study of [122] suggested a project-based learning technique to reproduce a multidisciplinary project environment through a combined course project innovatively.

3.5.4. Trans-Disciplinary

Five articles are trans-disciplinary because of overcoming the different disciplines, progressing beyond pedagogical disciplines to include communities such as universities, lecturers, students, and the public. The study of [123] proposed a theoretical basis, which is a different model as compared to the traditional way of teaching about sustainability through a competence-based course, in order to enable learning that encompasses necessary competencies to build a more sustainable society. The study of [124] described a service-learning pedagogic approach for HEI undergraduate students in an experiential workshop where a successful business canvas is applied as a tool for collaborative visual business modelling. The study of [125] highlighted the importance of living labs as innovation infrastructures in HE and exhibited the specific educational experiences of Living Lab LOW3—laboratory for sustainable architecture and lifestyle. The study of [48] created ways to deal with gaps in developing sustainability and leadership education by influencing research to be carried out and developing approaches to endorse future generations of academicians. The study of [38] provided and illustrated a generic framework for deep learning in a sustainability-based course for HE instruction.

3.5.5. Creation

Fifteen articles created a new ESD-centred course, program or approach because the focus was on the integration of SD and/or ESD in the development of the latest syllabus, program and approach. The study of [126] presented a fact-finding and simulating study of a teaching experience based on the action and experiential learning approaches through gamification. The study of [127] facilitated the understanding of different human controlled and/or initiated impacts on the natural environment through team and personalized activities. The study of [128] answered what kind of courses and teaching–learning conditions could be used in trans-national partnerships to enable future generations to tackle sustainability issues across different gradations and contexts. The study of [129] presented an analysis of the social learning process encountered in the interdisciplinary, intercultural competencies for a sustainable socio-economic development (CASE) team during the participatory development process of the new master’s program. The study of [130] considered the structure and relation of energy-related information in the textbook that contains both fundamental and applied subjects in an education program. The study of [131] presented a new program on renewable energy. The study of [132] adapted a pedagogical co-competition strategy, creative problem solving (CPS) and abbreviated Torrance Tests of Creative Thinking for accurately measuring creativity, in order to predict the influences of the learning environment. The study of [133] explored how collaborations with pupils could help sustainable lecturers to refine the living theory of their practice and improve the implementation of this practice in society. The study of [134] expressed the advancement of an international postgraduate program by an international consortium, which aimed to combine advanced ICT with environmental, economic and social awareness. The study of [13] presented a case study of the development and implementation of a university-wide first-year course focussing on the topic of sustainability. The study of [42] reported on a course for chemical engineering at the University of Cape Town (UCT) and
closely inspected the first sustainability core course. The study of [135] discussed one of the successful proposals for the energy efficiency training program, which was designed by the New South Wales Office of Environment and Heritage and the Department of Education and Communities. The study of [136] presented the practice and the universal framework adopted in the USE Efficiency program. The study of [137] presented the development process of a practical toolkit to support the amalgamation of eco-design in engineering programs, as well as the conceptualization, materialization and application of the tool. The study of [138] presented the process for developing the bachelor’s degree course in engineering for SD at Tecnológico de Monterrey, Mexico.

3.5.6. Other

Fourteen articles are non-integrative because they deal with the analysis rather than the integration and/or accomplishment of SD into HEI courses and curricula. The study of [139] considered transformative learning applied in an American university with the objective being a centre for excellence for sustainability in transformative teaching and learning. The study of [140] utilized theoretical inquiry to examine the need for transforming conventional, industrial scientific, HE courses and pedagogy. The study of [29] discussed how the challenges are linked to the presence of sustainability in engineering education. The study of [86] reviewed recent theoretical discussions on ESD and competence-based teaching and related them to the international policy processes of the SDGs implementation, where ‘the knowledge and skills needed to promote SD’ are expressed in SDG 4.7. The study of [17] reviewed the effort for embedding sustainability education in learning and teaching by educators. The study of [141] explained the maturity of an international master’s degree program by an international consortium, which integrated advanced ICT with environmental, economic and social awareness. The study of [142] highlighted the lack of knowledge about the role of work-based learning in education for SD and the urgent demands of climate literacy. The study of [105] outlined two postgraduate programs that successfully integrated sustainability context into education and courses, research and innovation, and students’ involvement in the culture of social responsibility and activities beyond the course in the classroom. The study of [87] presented an empirical analysis of ESD related to regional planning. The study of [143] examined the role of paradigms in engineering practices and presented a system science approach for the analysis of paradigms. The study of [36] presented a new course development method for stimulating discussions about the learning outcomes of degree programs. The study of [144] explored the practical and theoretical principles of course-centred strategic planning and inspected how this course can be implemented in the corresponding teaching structures to improve student experiences. The study of [67] characterized the profile of strategic environmental evaluation in HE in two different countries: Portugal and Brazil. The study of [145] suggested a comprehensive approach to the learning outcomes of sustainability in HE.

3.6. University Management

A total of six articles offered the results and discoveries of research on university management. These articles investigated behavioural and university transformation, concentrating on measuring HEI’s SD performance, structural carbon footprint, and aspiring to evaluate sustainability in HEIs.
4. Distribution Results

Figure 3 shows the number of articles by the database: Web of Science (118 articles), ScienceDirect (12 articles) and IEEE Xplore (two articles). The researchers have also conducted a manual search of 16 articles in which the titles and abstracts are found to be related to this specific research topic. Thereafter, a total of 148 articles are used to perform the full-text reading.

Figure 3. Number of articles by database.

Figure 4 shows the number of articles by continent: North America (18 articles); South America (one article); Europe (52 articles); Asia (11 articles); Oceania (four articles); and Africa (one article), and those of a more global nature or not relating to one continent (61 articles) based on the databases Web of Science, ScienceDirect and IEEE Xplore, as well as the manual search. For each continent, based on the databases of Web of Science, ScienceDirect and IEEE Xplore as well as hand search, respectively, the numbers of articles are as follows: North America ($n = 14, 2, 0, 2$); South America ($n = 1, 0, 0, 0$); Europe ($n = 41, 4, 0, 7$); Asia ($n = 9, 2, 0, 0$); Oceania ($n = 2, 0, 0, 2$); Africa ($n = 0, 0, 0, 1$); and not relating to one continent ($n = 52, 3, 2, 4$).

Figure 4. Number of articles by continent.
Figure 5 shows the number of articles by category: the accomplishment of SD (26 articles); awareness and commitment (30 articles); evaluation and commentary (26 articles); structural transformation (11 articles); course coordination (49 articles); and university management (six articles) based on the three databases and manual search. For each category, based on the databases of Web of Science, ScienceDirect and IEEE Xplore as well as hand search, respectively, the numbers of articles are as follows: accomplishment of SD \((n = 24, 1, 0, 1)\); awareness and commitment \((n = 22, 3, 1, 4)\); evaluation and commentary \((n = 20, 4, 0, 2)\); structural transformation \((n = 8, 2, 0, 1)\); course coordination \((n = 38, 2, 1, 8)\); and university management \((n = 6, 0, 0, 0)\).

![Diagram showing number of articles by category.](image)

**Figure 5.** Number of articles by category based on different searches.

Figure 6 shows the number of articles on the accomplishment of SD, awareness and commitment, evaluation and commentary, structural transformation, course coordination and university management by publication year from 2014 to 2019. There is a total of nine articles in 2019; 44 articles in 2018; 25 articles in 2017; 17 articles in 2016; 37 articles in 2015; and one article in 2014. For each year, in descending order from 2019, 2018, 2017, 2016, 2015 and 2014 based on the category, respectively, the numbers of articles are as follows: accomplishment of SD \((n = 2, 5, 4, 5, 5)\); awareness and commitment \((n = 2, 10, 4, 2, 8, 4)\); evaluation and commentary \((n = 1, 10, 5, 4, 5, 1)\); structural transformation \((n = 1, 2, 2, 1, 5, 1)\); course coordination \((n = 3, 15, 9, 4, 13, 4)\); and university management \((n = 0, 2, 1, 1, 1, 1)\).
5. Conclusions

Education is the primary means for achieving the goal of sustainability, and the implementation of sustainability in HEIs is the prime matter in academia. For this reason, campus sustainability has evolved significantly since its inception towards more formal, holistic and extramural policies. However, based on the systematic review, there is a wide variety of perceptions among faculty and staff regarding their functions on contributions to SD. Moreover, there were very few individuals in positions of management who perceived inspiration to be a part of their function, although management are crucial role models for internal stakeholders.

Students were also more cautious about environmental sustainability as compared to social and economic sustainability. It is also reported that exposure to sustainability education led to slight moves in students’ sustainability execution. Moreover, students generally regarded sustainability competencies to be crucial for the future labour market and, although they planned to develop their sustainability competencies, they found that HEIs do not offer holistic ESD programs.

The assessment process constitutes one of the many opportunities to transform higher education, as the assessment reports can aid HEIs to establish the correct goals towards sustainability. The evolution of sustainability occurred classically as immediate processes that grow and are established over time. The maturation is not an undeviating process, and there could be an impediment, gaps and accelerations. Therefore, ESD is a transformative education that guides students to study and live more sustainably. Students then perceived problem-based learning (PBL) to be respected and engaged in applicable lessons for embracing sustainability.

Although there is an abundance of studies concerning ESD, insight into the literature discovered that there is some concern. The goal of this article was to contribute by investigating and categorizing related works. Various trends can be drawn from the taxonomy of ESD. These works are categorized into six classes, namely, the accomplishment of SD,
awareness and commitment, evaluation and commentary, structural transformation, course coordination and university management. This study further investigates these categories and constructs sub-categories to offer a more comprehensive examination of ESD. The results signify that there is a lack of commentary on structural transformation and university management. Furthermore, although intercontinental or global studies were reported, there is still a need for research from continents other than Europe and North America to gain a more generalized understanding of ESD implementation into HEIs. Despite there being an increase in ESD literature, the most relevant limitation of this review is the amount and distinctiveness of the foundation databases, although the selected basis is consistent and is broadly representative of collections. Moreover, the swift advancement in the field of ESD hinders the relevance of the survey. The findings of the review echo the reaction of the research stakeholders to ongoing trends, in which the objective of this review is achieved. Thus, it is recommended that continuous research be conducted on holistic models for implementing and/or integrating ESD into HEIs.

Through this systematic review, the main contribution of this study has managed to derive some future directions and recommendations for different parties. The recommendations for HEIs are to continue to professionally develop and engage academics and to increase awareness in society of the need for experts with sustainability concerns in all areas of knowledge. The HEIs also play a vital role in promoting the development of a pluralist approach to the sensitive issue of sustainability in a global dimension. There is also a need to strengthen collaboration and the discussion of sustainability amongst HEIs themselves, as they need to foster internationalization, and thus, HEIs can sign clear and consistent policy agreements. The development of policy actions can encourage universities to engage in sustainability reporting, which is essential to advance ESD in HEIs’ systems.

The recommendation for other stakeholders is to continue to support the HEIs in capacity-building for SD with local communities, in order to maximize their contribution towards SD. These stakeholders can engage with the broader community to unlock opportunities for knowledge advances for the stakeholders involved, which can be significant to increase the efficiency, economy and effectiveness of teaching and/or training programmes. Close collaboration and intensive dialogue between those involved in the teaching and/or learning process is also needed for greater academic linkages. Briefly, all parties needed to work together and establish more in-depth research on the social profile of the academic community, as well as the specific institutional characteristics of HEI systems.


Funding: The Article Processing Fee was funded by Wawasan Open University, Penang (Publicationfund-WOU-CeRi-003).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available upon reasonable request from the corresponding author.

Acknowledgments: The authors want to acknowledge the crucial role of participants, members of our research teams and all stakeholders involved in the data collection.

Conflicts of Interest: The authors declare no conflict of interest.

References


5. Vieidemane, A. Education for Sustainable Development in Higher Education Rankings: Challenges and Opportunities for Developing Internationally Comparable Indicators. *Sustainability* 2022, 14, 5102. [CrossRef]


27. Molderez, I.; Ceulemans, K. The power of art to foster systems thinking, one of the key competencies of education for sustainable development. *J. Clean. Prod.* 2018, 186, 758–770. [CrossRef]


42. de Freitas, P.; Caeiro, S.; Azeiteiro, U.M.; Filho, W.L. Sustainable universities—A study of critical success factors for participatory approaches. *J. Clean. Prod.* **2015,** *106,* 34–44. [CrossRef]


78. Pattinson, C. ICT and Green Sustainability Research and Teaching. *IFAC Pap.* **2017**, *50*, 12938–12943. [CrossRef]


95. Zorio-Grima, A. Driving factors for having visibility of sustainability contents in university degree titles.


110. Esmaelbian, B.; Rust, M.; Gopalakrishnan, P.K.; Behdad, S. Use of Citizen Science to Improve Student Experience in Engineering Design, Manufacturing and Sustainability Education. Procedia Manuf. 2018, 26, 1361–1368. [CrossRef]


129. Cincera, J.; Biberhofer, P.; Binka, B.; Roman, B.; Mindt, L.; Rieckmann, M. Designing a sustainability-driven entrepreneurship course as a social learning process: A case study from an international knowledge alliance project. J. Clean. Prod. 2018, 172, 4357–4366. [CrossRef]


137. Verhulst, E.; Lambrechts, W. Fostering the incorporation of sustainable development in higher education. Lessons learned from a change management perspective. J. Clean. Prod. 2015, 106, 189–204. [CrossRef]


141. Klimova, A.; Rondeau, E. Education for cleaner production in Information and Communication Technologies course. IFAC Pap. 2017, 50, 12931–12937. [CrossRef]

