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# Awareness and skills at a distance: the contribution of distance learning higher education institutions to the implementation of the United Nations Sustainable Development Goals

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## Abstract

Distance Learning Higher Education Institutions (DL-HEIs) can advance the United Nations Sustainable Development Goals (SDGs) by expanding access to education, fostering research and innovation, and promoting collaboration on a global scale. This study aims to identify the strategies conducted by DL-HEIs to increase learners' awareness, knowledge, and skills related to the SDGs and explore how DL-HEIs around the world incorporate the SDGs into their activities. More specifically, it uses a mix of case studies and a global survey that covers six continents and 52 countries to identify important strategies, drivers, and barriers in this field. The case study findings reveal that technology in distance education fosters innovative teaching, boosting engagement and comprehension of complex sustainability topics. The survey results show that DL-HEIs mainly incorporate sustainability through their curriculum and research, with teaching staff and researchers as the main contributors. They often use a mix of live and recorded learning to teach skills like critical thinking, focusing on SDGs 4 (Quality Education), 5 (Gender Equality), and 13 (Climate Action). While commitment from institutions and sustainability policies are significant drivers, limited financial resources and awareness create obstacles. The study concludes that technology-based distance education offers a strong and inventive platform for promoting global sustainability education.

**Keywords** Distance learning, Higher education institution, Sustainable development goals, Educational programmes

## 1 Introduction

### 1.1 Distance learning higher education institutions

Distance Learning Higher Education Institutions (DL-HEIs), also known as open or distance teaching institutions, have traditionally played a key role in the educational



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landscape. These institutions offer flexible, accessible, and often more affordable educational opportunities to a diverse population of learners [1]. This is because one of the primary roles of DL-HEIs is to provide access to education for individuals who might otherwise be unable to attend traditional brick-and-mortar institutions [2].

Distance Learning (DL) features several defining characteristics. The first one is the absence of barriers to access, as DL eliminates the need for students to be physically present on campus, making it possible for individuals in remote or rural areas to pursue higher education. The second feature is flexibility, especially for non-conventional students [3, 4]. Many DL students are working professionals, parents, or individuals with other significant commitments. The flexibility of online courses allows them to balance their studies with different responsibilities [5, 6]. A third feature is inclusivity, in the sense that DL-HEIs often cater to a more diverse student body, including those with disabilities, older students, and international students, fostering a more inclusive educational environment [7–9]. In this sense, DL-HEIs play a vital role in promoting lifelong learning. They offer opportunities for individuals to continue their education beyond traditional age limits, enhancing their skills and knowledge throughout their lives. This is particularly important in today's fast-paced, ever-changing job market, where continuous professional development is essential [10, 11].

These institutions are also at the forefront of integrating technology into education [12]. They use digital tools and platforms to deliver content, facilitate interaction, and assess students. This includes: (i) Learning Management Systems (LMS): Platforms like Moodle, Blackboard, and Canvas, which provide storage and dissemination possibilities for course materials, assignments, and communications [13]; (ii) Multimedia Resources (MMRs): Videos, podcasts, and interactive simulations enrich the learning experience and cater to different learning styles [14]; and c) Online collaboration tools: Tools like discussion forums, video conferencing, and collaborative documents allow for interaction and group work, fostering a sense of community among remote learners [15–17]. DL-HEIs have prompted traditional institutions to adopt online and hybrid learning models, expanding the reach and flexibility of their programmes [18, 19]. Furthermore, the innovations and best practices developed by DL-HEIs often influence broader educational strategies and policies [20]. This was seen during the COVID-19 pandemic: whereas conventional Higher Education Institutions (HEIs) struggled to convert their teaching to online to cope with the pandemic, DL-HEIs were able to conduct their work in a usual way [20, 21].

A further element that characterises DL-HEIs is their cost-effectiveness [22]. DL-HEIs often present a more cost-effective alternative to traditional HEIs. Reducing overhead costs associated with physical infrastructure allows these institutions to offer lower tuition fees. Moreover, students save on commuting, housing, and other expenses related to on-campus living [23, 24]. By being accessible, flexible, and inclusive, and by leveraging technology, promoting lifelong learning, and offering cost-effective alternatives, DL-HEIs are essential players in the education landscape [10, 22, 25]. Table 1 provides an overview of specific characteristics of DL-HEIs, compared with conventional ones.

Even though DL-HEIs offer numerous benefits, they also face specific challenges. One challenge relates to ensuring the quality and rigour of online education. DL-HEIs need to develop robust course design, delivery, and assessment systems to maintain high educational standards [26]. Another challenge is keeping students engaged and motivated,

**Table 1** Specific characteristics of DL-HEIs.

Source prepared by the authors

Feature	Implications
Outreach	Reaches several thousands of students
Sense of community	Virtual communities linking learners from various countries
Operational costs	Lower tuition fees
Continuous assessments	Less reliance on conventional exams
Digital Resources	Course materials are primarily delivered electronically, including e-books, online articles, videos, and interactive modules
Technology Integration	Courses often incorporate various multimedia tools and technologies to enhance learning, such as simulations, virtual labs, and interactive quizzes
Self-Paced Learning	Many DL programmes allow students to progress through courses at their own pace, providing a more personalised learning experience

which can be challenging in a virtual environment and can be subject to many distractions [27, 28]. Strategies to enhance engagement may include interactive content, regular feedback, and fostering a solid online community [29].

Moreover, technology may pose a barrier. While DL relies on technology, not all students have equal access to the necessary devices and internet connectivity. Addressing this digital divide is essential to ensure equitable access to education [4, 18].

Based on this context, the research question addressed in this paper is: to what extent are DL-HEIs engaged in the implementation of the United Nations Sustainable Development Goals (SDGs)? The problem the paper attempts to tackle is whether these institutions recognise their role and are actively leveraging it to address global challenges like poverty (SDG 1), inequality (SDG 10), and quality education (SDG 4), or if they do not yet realise this potential.

## 1.2 DL-HEIs and sustainable development

DL-HEIs, much like other HEIs, play a crucial role in achieving the Sustainable Development Goal (SDG) 4 (Quality Education). HEIs, regardless of the mode of teaching and learning, are critical in ensuring that the necessary skills, capabilities, and knowledge related to the SDGs (Targets 4.3, 4.4, and 4.5) are appropriately transferred to their graduates [30]. Due to the open nature of DL-HEIs across the globe, they can accommodate more learners from a wider geographical area. They can thus contribute significantly to ensuring inclusive and equitable quality education across boundaries and, at the same time, are uniquely equipped to contribute to the drive towards lifelong learning [31]. The opportunities that DL-HEIs can provide through lifelong learning may contribute significantly to transformative change within social justice, equality, and environmental sustainability required for achieving the SDGs [32]. In particular, the Inner Development Goals Framework [33], which considers dimensions such as being/relationship to self, thinking/cognitive skills, relating/caring for others and the world, collaborating/social skills, and acting/enabling change, can foster human systemic change and serve as a driver for societal transformation.

The literature [32, 34, 35] highlights three major themes regarding the strategies that DL-HEIs can follow to ensure their contribution to Sustainable Development (SD): (i) the design and development of curricula and pedagogy; (ii) the orientation of the learner experience and the SDG alignment of graduate outcomes; (iii) institutional management, capacity building, and participation in cross-regional network and initiatives, coordination, and co-operation. By focusing on these strategies, DL-HEIs can help graduates

from these HEIs be equipped with relevant skill sets to contribute to the efforts at multiple levels of society towards SD.

Regarding the first theme, according to Holmes et al. [32], many DL-HEIs started mapping how SD has been infused into their curricula and identifying the gaps in teaching and learning to address the SDGs effectively. At various DL-HEIs, this exercise resulted in different results, ranging from the development of Massive Open Online Courses (MOOCs) [36, 37] to the development of new undergraduate and postgraduate programmes [38–40] explicitly dedicated to SD. Many DL-HEIs have infused more SD into single disciplines [41], while others have included SD in interdisciplinary programmes [31, 42, 43]. Not only have many DL-HEIs moved towards mainstreaming SD into their curriculum, but many of these institutions have critically evaluated and re-aligned their pedagogy towards more SD thinking [43, 44] by critically assessing their online teaching practices to ensure that the pedagogy followed in their programmes or subjects is well aligned to SD. Despite significant reporting on this theme for traditional HEIs, there are still critical shortcomings in the literature on how SD is infused into relevant curriculum and pedagogies of DL-HEIs, including but not limited to the development of unified theoretical frameworks; the more rigorous empirical evaluation of their pedagogical practises; and the reporting on more unified assessment frameworks that are relevant to DL-HEIs.

The second theme includes DL-HEIs' strategies to enhance the student experience towards the SDGs. DL-HEIs have increasingly included more Work-Integrated Learning (WIL) programmes to expose their future graduates to relevant work-related experience [41]. This type of exposure ensures that students are exposed to specific competencies such as systems thinking [38], value thinking, action learning [45], and integrated problem-solving in real-world situations [46], making them more employable and meaningful global citizens [47]. One of the real advantages of DL-HEIs is their ability to present MOOCs to professionals already working in SD to enhance and update SD knowledge, skills, and competencies related to lifelong learning [37]. To enhance the students' gradueness and experience of the SD, more research needs to be documented on the best practises of how DL-HEIs have succeeded in placing a greater emphasis on the social and cultural dimensions of SD including how these institutions ensure that their experience with SD is closer to their own lifeworld through more inclusive representation of both the Global North and Global South perspectives.

The third theme relates to institutional leadership and capacity building, which includes the development of SD strategies within the institution [48–50], internal communication [51], the provision of research incentives to undertake SD-related research, and the possible creation of research centres that focus on SD [52]. Moreover, although cross-regional networks between DL-HEIs and more traditional HEIs could provide helpful strategies for sharing critical information and initiatives related to SD training in the HEIs space [53–55], as well as stakeholder partnerships between DL-HEIs and surrounding communities [56–58], relevant reporting of best practices in this regard in DL-HEIs is limited.

The existing literature on higher education and the SDGs mainly focuses on traditional, campus-based HEIs. It highlights their research, teaching, and campus operations [20, 48–50]. In contrast, there is a significant gap regarding DL-HEIs in terms of the three themes highlighted above. Although some studies have explored sustainability

practices in specific DL contexts [31, 36, 51, 54], the field remains largely unexplored how these unique, digitally native institutions—often without physical campuses and with globally distributed stakeholders—are incorporating the SDGs. This creates an important blind spot in understanding the overall contribution of the higher education sector to the 2030 Agenda and the specific role of scalable, online education in promoting global sustainability [32].

Moving forward, this study aims to identify the strategies used by DL-HEIs to increase learners' awareness, knowledge, and skills related to the SDGs. More specifically, it explores the pedagogical and institutional approaches DL-HEIs employ to integrate sustainability into their programmes and the barriers and drivers they face in integrating SDG-related content into the DL context.

To clarify our theoretical grounding, we position the study at the intersection of the whole-institution approach to sustainability in higher education and competency-oriented frameworks for education for sustainable development in distance learning contexts. The whole-institution lens, recognised in HEI frameworks and reflected in the United Nations Environment Programme (UNEP) guidance [59], organises sustainability across education, research, operations, governance, and outreach activities, therefore indicating where DL-HEIs may integrate the SDGs most visibly. In parallel, competency frameworks such as the Inner Development Goals [33] and GreenComp [60] specify the learning outcomes that SDG-oriented teaching should cultivate in online and hybrid formats. Building on these strands, our conceptual model treats digital affordances and institutional capacity as enabling mechanisms that connect whole-institution inputs to core academic functions, curriculum and research, and to two observable outputs, SDGs coverage in programmes and learner competencies. This framing motivates our mixed-methods design, the case studies interrogate how the three literature-derived themes are enacted in context, the survey quantifies integration across whole-institution dimensions, pedagogical approaches, and competencies, and SDG coverage reported in the results.

## 2 Methods

This study applied two distinct but complementary methods: case study analysis and a survey as a mixed-methods approach [61]. The case studies provided in-depth, context-specific insights into DL-HEIs' practices and strategies for implementing sustainability and SDGs, allowing exploration of more qualitative aspects, such as pedagogical innovation. In contrast, the survey offered a broader quantitative overview of trends and patterns across a more diverse and geographically distributed sample. Combining these two methods enabled us to reflect on how sustainability is enacted in practice as well as to quantify how widely such practices occur.

### 2.1 Case study method

Following guidelines for case-based research [62], sixteen case studies were purposefully selected to provide a window on the spectrum of approaches according to which DL-HEIs across the world are implementing SD and the SDGs in their activities. This selection was sensitive to include a balanced representation of DL-HEIs from different continents, both the Global South and North, and different types of DL-HEIs (i.e., dedicated distance education, open distance learning, e-learning, and hybrid models).

This selection was limited to those case studies on which peer-reviewed published material was available and was furthermore aligned to the themes identified in the literature review (see Sect. 1.2), namely: (i) curriculum, pedagogy, teaching, and learning; (ii) graduation and student experience; (iii) management, operationalisation, coordination, and cooperation. In order to address the research question for this paper, the analysis of the case studies focused on the nature or type of the contribution at each of the HEIs, and the role played by it in SD and the SDGs.

## 2.2 Data collection through survey

As a second approach, an online survey was designed to collect data from the DL-HEIs. The survey, in particular, targeted faculty (teaching and research) and staff (administrators and technical) of all DL-HEIs worldwide who actively pursue the SDGs in their institutions. The survey explored how their institutions contribute to increasing awareness, knowledge, and skills related to the SDGs, mainly through teaching relevant subjects and their implementation.

The survey consisted of 25 questions (see supplementary material, Survey), both closed and open-ended, divided into four sections: (i) participants' background information; (ii) general approaches to sustainability in DL-HEIs; (iii) approaches to teaching SDGs in DL-HEIs; and iv) barriers, drivers, and future perspectives on the topic. The close questions were formatted as multiple-choice with predefined responses, except for a question on future perspective, which applied a five-point Likert scale ranging from 1 (very low) to 5 (very high) [63]. Details of the content and focused items of the survey are presented in Table 2.

To increase the validity of the responses, an initial question was included in the survey to confirm whether the participants were currently affiliated with DL-HEIs, thereby excluding participants from regular HEIs. For the validation phase, following the methodology suggested by Habidin et al. [64], five external academic experts with experience in SDG implementation and teaching in HEIs reviewed the survey as a pre-test. The experts were teaching staff from both DL-HEIs and traditional HEIs, representing a diverse geographical spread (Spain, the United States, Finland, France, and Malaysia). During the validation, the experts were asked to: (i) assess the accuracy of the questions, (ii) evaluate their relevance to the research objectives, (iii) ensure the questions were effective and clear, and (iv) provide feedback on additional aspects such as survey length, clarity of response options, and potential new items. The experts also completed the survey themselves to test its feasibility, including the functionality of the online tool

**Table 2** Content and specific items covered by the survey.

Source prepared by the authors

Content	Focused item
1. Participants' background information	Demographic and professional details (such as age, gender, academic degree, type of institution, country, position at institution, and associated disciplinary area)
2. General approaches to sustainability in DL-HEIs	Exploring how the institution approaches sustainability in general, beyond the pedagogical integration of the SDGs (such as implementing sustainability in certain areas of the whole-institution approach, and the existence of a sustainability office/unit)
3. Approaches to teaching SDGs in DL-HEIs	The pedagogical approach methods used for teaching the SDGs (such as education programmes, field of study, predominant SDGs, resources applied, competences developed, and assessment methods)
4. Barriers, drivers, and future perspectives	Exploring the barriers faced by DL-HEIs in teaching the SDGs, the drivers for implementing sustainability-related initiatives, and the future perspective towards 2030

and overall usability from a participant's perspective. Revisions were made based on the reviewer's feedback. This validation process ensured the survey was suitable for capturing relevant data on DL-HEIs' engagement with SDG-related teaching and initiatives.

Participants were recruited using purposive, snowball, and opportunistic sampling methods through relevant networks, academic mailing lists, and university affiliations. Specifically, those affiliated with DL-HEIs were compiled from SCOPUS and Web of Science databases, as well as from established DL-HEI networks such as the European Association for Distance Teaching Universities (EADTU). The initial contact list included approximately 4,000 potential participants. These methods were adopted due to the absence of a comprehensive global database of DL-HEIs and to ensure broad coverage across continents and institutional types. Inclusion criteria required respondents to be currently affiliated with accredited DL-HEIs, verified through an initial screening question in the survey (see supplementary material, Survey). Also, before completing the survey, each participant was required to follow an ethical protocol and provide consent, ensuring respondent anonymity. The online survey was disseminated to potential participants from November 2023 to January 2024, with a reminder sent midway. In total, 221 responses were received, among which 1 response did not provide consent, and 92 responses were not associated with DL-HEIs and were therefore removed. This resulted in 128 valid responses from 52 countries across six continents being analysed, all associated with DL. Although this represents a relatively moderate response rate, it is consistent with those typically observed in large-scale international online surveys in higher education [65]. As noted by Nulty [64], lower response rates can still yield reliable and valid results when the sample is diverse and representative of a heterogeneous population—a condition that applies to this study, given its broad geographical, disciplinary, and institutional type coverage.

Descriptive data analysis was conducted on the closed questions, focusing on the average percentage of the responses for each question [44], while the open questions (Total: 3) were analysed using content analysis, following repetitive cycles of developing, refining, grouping, and labelling categories, based on Ghahramani's [66] method.

### **3 Results and discussion**

#### **3.1 Case studies results**

The critical reflection on and analysis of the sixteen case studies provide insight into the spectrum of approaches, successes, and challenges DL-HEIs face in promoting SD and the SDGs in their various contexts. The key points are detailed in Table 3, which shows examples of initiatives at DL-HEIs that are used to leverage technology, such as digital textbooks and online assessments, methods to integrate sustainability concepts into their curricula, emphasising ecological literacy and responsible citizenship, programmes involving local communities or partnerships with organisations focused on sustainability initiatives, as well as management and operational initiatives. Following Table 3, a systematic critical reflection on and an analysis of the case studies are provided, which highlights the different ways in which the activities at these DL-HEIs are supporting SD and the SDGs. This critical reflection and analysis is structured according to the three main themes identified in Sect. 1.2 of this paper, which are: (i) Curriculum, pedagogy, teaching and learning; (ii) Graduateness and student experience; and (iii) Management, operationalisation, coordination, and cooperation.

**Table 3** Case studies on the contribution by DL-HELs to SD and the SDGs.

Source prepared by the authors

Case study	Institution and Country	Type and nature of contribution	Role in SD/SDGs	References
<i>Theme 1: Curriculum, pedagogy, teaching and learning</i>				
1	University of South Africa, South Africa	Use of Inquiry-Based Learning (IBL) in Open and Distance Learning (ODL)	Application of IBL (in the context of modules of "Geography of tourism" and "Ecotourism") to support transformative learning towards Education for Sustainable Development—SDG 4	[42]
2	Federal University of Rio Grande do Sul, Brazil	Case study and action research to evaluate an DL discipline	Teaching about socio-environmental management in companies and evaluating the pedagogies strategies—SDGs 4 & 12	[43]
3	Indira Gandhi National Open University, India	Case study to develop a new DL programme	Proposal of a new post graduate programme on Development Communication, offered through Open and DL – SDG 4	[40]
4	FernUniversität Hagen, Hagen, Germany and Universidade Aberta, Portugal	Case study of a DL post-graduation course	Teaching on participatory processes in environmental politics using flipped classroom and applying different e-learning tools and evaluating and comparing its effectiveness – SDG 4	[44]
5	Universidade Aberta, Portugal	Case study of DL 1st to 3rd cycle programmes	Evaluate expectations and experience of students who enrolled in more than one programme in DL in environmental and/or sustainability science – SDG 4	[6]
6	Universidad Internacional de La Rioja, Spain;	Case study of DL engineering education	Demonstrate how DL can promote quality, inclusion and equitable education and provide lifelong learning opportunities for all its students – SDGs 4, 10 & 13	[31]
<i>Theme 2: Graduateness and student experience</i>				
7	University of South Africa, South Africa	Case study on use of WIL in DL	Application of WIL in DL for training of nature conservation students – SDGs 4, 8 & 15	[41]
8	Tecnologico de Monterrey, Mexico	Case study on use of challenge-based pedagogy in DL	Learning through interaction with SD and SDG challenges to foster employability, and entrepreneurial and citizenship skills – SDGs 4 & 8	[47]
9	Copenhagen Business School, Denmark and Kristianstad University, Sweden	Case study on use of MOOCs	Rollout of courses on SD and the SDGs in non-formal and informal education while exploring the use of MOOCs – SDG 4	[37]
10	German Sport University, Germany	Case study on student activities outside the curriculum	Maps the field of e-learning connecting sport and SD, and proposes ways to provide more engaging and inclusive experiences – SDGs 3 and 4	[45]
11	Krishna Kanta Handiqui State Open University, India	Research study of women empowerment through DL	Maps the contribution of DL to community engagement and empowerment through DL programmes focused on women in Assam (India) – SDGs 1, 2, 3, 4, 8 & 10	[46]
<i>Theme 3: Management, operationalisation, coordination, and cooperation</i>				
12	AVANS University of Applied Sciences, the Netherlands	Case study on optimizing educational management and planning	Operationalisation and coordination in function of lowering carbon footprint related to student mobility – SDGs 4, 12, 13	[48–50]
13	St. Mary's University, Ethiopia	Case study focusing on issues of assessment, communication and management	Contribution of higher education to SD transition – SDGs 4, 12, 13	[51]

**Table 3** (continued)

Case study	Institution and Country	Type and nature of contribution	Role in SD/SDGs	References
14	Partnership of 11 European universities led by the Open Universiteit, the Netherlands	Case study on International Virtual Seminar	Quality education in online learning environments – SDG 4	[53, 67]
15	Madrid Open University, Spain and Universidade Aberta, Portugal	Case study on the use of STARS	Sustainability assessment using STARS offers insights in management and coordination in higher education – SDG 4	[54]
16	Open University, Tanzania	Case study on collaboration	School-community collaboration – SDG 4	[58]

### 3.1.1 Curriculum, pedagogy, teaching and learning

DL in higher education can be relevant in effective life-long learning for SD and the SDGs to promote quality, inclusion, and equitable education and provide learning opportunities for all students [31], including students who are simultaneously full-time employees. These authors from the Universidad Internacional de La Rioja, Spain, present the example and the advantages of their 100% online methodology within engineering education in the face of the SDGs. In addition, Yadav et al. [40], from Indira Gandhi National Open University, reinforce that DL can be beneficial for training practitioners and working professionals and propose programmes in development communication within the context of social inequalities in India. Azeiteiro et al. [6], in the study from Universidade Aberta, Portugal, concluded that surveyed students who enrolled in more than one programme in environmental and/or sustainability science attained a high level of motivation and satisfaction and reached an effective learning outcome of knowledge, competencies, values, attitudes, and behaviour in environmental and/or sustainability sciences.

Several pedagogies can be used in a DL regime, following innovative and collaborative approaches that can be student-centred. Perbandt et al. [44], in Portuguese and German DL universities, used flipped classrooms, applied different e-learning tools (from synchronous and asynchronous activities), and assessed their effectiveness, demonstrating the advantages and disadvantages of the various approaches regarding knowledge and skills. Also, Trevisan et al. [43], at the Federal University of Rio Grande do Sul, Brazil, assessed strategies, tools, and resources used during a DL course about socio-environmental management, finding that DL supported the students' transformative learning towards sustainability. Relating to transformative learning and pedagogies, the use of Inquiry-Based Learning (IBL) in Open and Distance Learning (ODL) is also effective in the context of Africa at the University of South Africa by Pretorius et al. [42].

### 3.1.2 Graduateness and student experience

In association with the criticism that HEIs that focus on and/or incorporate DL do not produce employable graduates [68, 69], various initiatives by such institutions to enhance the student experience have increased momentum over the past two decades. This includes attention to SD and the SDGs in multiple ways, which support prospects for inclusivity, collaboration, networking, connection, and innovative learning through DL [70]. For example, Work-Based Learning (WBL) refers to the DL nature conservation diploma of the University of South Africa, which is blended with practical sessions

and Work-Integrated Learning (WIL). Wilson and Pretorius [56] explain how this prepares students for employment in skills-based sectors with a sustainability focus, such as nature conservation, with the value added in this way a significant advantage. Another example, from the Tecnológico de Monterrey (Mexico), concerns employability, entrepreneurship and citizenship. Here, Portuguese Castro & Gomez Zermeno [47] describe the implementation of an online entrepreneurship course that presents SDG challenges to students, with results that generate sustainable business ideas to resolve local, national and global problems.

Informal/non-formal learning is another way DL at HEIs may enhance the student experience in promoting SD and the SDGs. An example is provided by the coverage of these topics in MOOCs offered by the Copenhagen Business School (Denmark) and Kristianstad University (Sweden) [37]. Regarding sustainability and student activities outside the curriculum, the Sport for Development Movement provides an exciting example. It is concerned with e-learning connecting sport and SD, with the work by Ruck and Moustakas [45] from the German Sport University in Cologne serving as an example. Community engagement and empowerment present another avenue for enhancing the student experience in DL by promoting SD and the SDGs. In this regard, Saikia [46] from the Krishna Kanta Handiqui State Open University (India) considers how DL courses taken by women in Assam (India) help them to enhance their knowledge, develop their capacities and skills, empower them, and provide recommendations for improvement of this initiative.

### **3.1.3 Management, operationalisation, coordination, and cooperation**

A growing academic interest has emerged in assessing sustainability practices of DL-HEIs, for example, to enhance their role as agents of change and mitigate carbon emissions [54]. One way of strengthening sustainability integration is to employ rigorous sustainability assessment tools such as the Sustainability Tracking, Assessment, and Rating System (STARS) [71]. Casado-Aranda et al. [54] present and compare STARS use at two DL universities, the Madrid Open University in Spain and Universidade Aberta in Portugal. Findings reveal commonalities in low campus operation performance but highlight strengths in sustainability courses and programme offerings [54]. Similarly, studies like Tamrat [51] delve into specific institutions, such as the College of Open and Distance Learning (CODL) at St. Mary's University, Ethiopia, assessing the integration of sustainability. Despite policy directives, CODL's approach reveals significant gaps in research and community outreach activities [51]. These studies emphasise the importance of operationalising sustainability goals into practices, ensuring sustainability becomes ingrained in DL.

Studies in the Netherlands have been comparing online and on-campus activities [48–50]. Blended learning approaches, combining online and on-campus activities, offer pedagogical design principles focused on self-regulation, community building, and student collaboration [50]. In some cases, students might prefer DL over on-campus learning, which can inform curricular redesign efforts in light of measuring and mitigating scope three carbon emissions resulting from higher education practices [48]. One of the pedagogical design principles Versteijlen & Wals [50] put forward is the engagement with industry partners, non-profit organisations, and government agencies to address

sustainability challenges collectively. Encouraging such engagement in DL environments remains challenging.

Issues of collaboration are focused upon in several articles. The European Virtual Seminar (EVS) on SD exemplifies international cooperation in fostering competencies for sustainability through online learning [53, 67]. The studies show that EVS has the potential to enhance student interactions and learning, though it remains challenging to balance synchronous and asynchronous activities [53]. Focusing on competencies for sustainability, EVS has the potential to enhance the professional development activities of teaching staff [67]. In Africa, DL-HEIs play a crucial role in increasing access to education, yet studies on community engagement remain scarce. Mkwizu & Mtae [58] present the case of Tanzania and highlight the potential for DL-HEIs to promote community engagement aligned with SDGs, contributing to regional socio-economic development.

### **3.1.4 Concluding observations on case studies**

The critical reflection on and analysis of the sixteen case studies according to the three identified themes reveals several of the strategies implemented by DL-HEIs to increase students' awareness, knowledge, and skills related to SD and the SDGs, as well as their associated strong and weak points. It is furthermore revealed that a variety of approaches can be implemented by HEIs to achieve sustainability in DL. However, success is context-dependent and will vary according to factors as the type of DL-HEI, the business model followed, and the location (Global North versus Global South). In addition, it must be taken into consideration that to yield the expected results, DL-HEIs must balance environmental goals with educational effectiveness, ensuring that sustainability initiatives enhance rather than detract from learning outcomes.

## **3.2 Survey results**

As a second approach, the survey results provide a set of insights, which are discussed in the following sub-sections.

### **3.2.1 Participants' background information**

Table 4 shows the socio-demographic profile of the survey respondents. The respondent's primary role at their HEI was teaching (60%), nearly one-fifth were researchers (19%) or had a leadership role (17%), and a minor proportion were non-academics (4%, including administrative and technical staff). A slight majority of the respondents were male (55%). Also, most were between 36 and 55 years old (62%), although the inclusion of respondents over 56 (28%) and under 35 (10%) enriched the dataset and provided insights from a broader range of age groups. Most respondents held a Doctoral degree (79%), with a smaller number having a Master's degree (14%). Only a few had a high school degree (2%) or a degree beyond a Doctorate (2%).

The respondents' disciplinary backgrounds were highly diverse, including business, education, social science, engineering, and technology (each around 16%), but also areas such as medical and health sciences (8%), communication, media and public relations, humanities, physics, mathematics and computing, and arts (each ranging from 4 to 2%). Most respondents (74%) were from public HEIs, with a smaller number from private HEIs (20%) and a minority (6%) from mixed public-private HEIs.

**Table 4** Participant background information.

Source prepared by the authors

Item	Percent	Item	Percent
<i>Age</i>		<i>Educational level</i>	
26–35	10	High school diploma	2
36–45	29	Bachelor's degree	2
46–55	33	Master's degree	14
56–65	22	Doctoral degree	79
>65	6	Other	3
<i>Gender</i>		<i>Type of institution</i>	
Male	55	Public	74
Female	44	Private	20
Other	1	Mixed	6
<i>Primary position</i>		<i>Disciplinary background</i>	
Teaching	60	Social sciences	16
Research	19	Education	16
Leadership role	17	Business	16
Administrative and technical	4	Engineering and technology	16
<i>Continent</i>		Biological, Natural, Agricultural, or Environmental Sciences	
Europe	46	Medical and Health Sciences	8
Asia	16	Communications, Media, and Public Relations	4
North America	14	Physical Sciences, Mathematics, and Computer Science	4
Africa	13	Humanities	3
South America	4	Art	2
Australia	6	Other	2

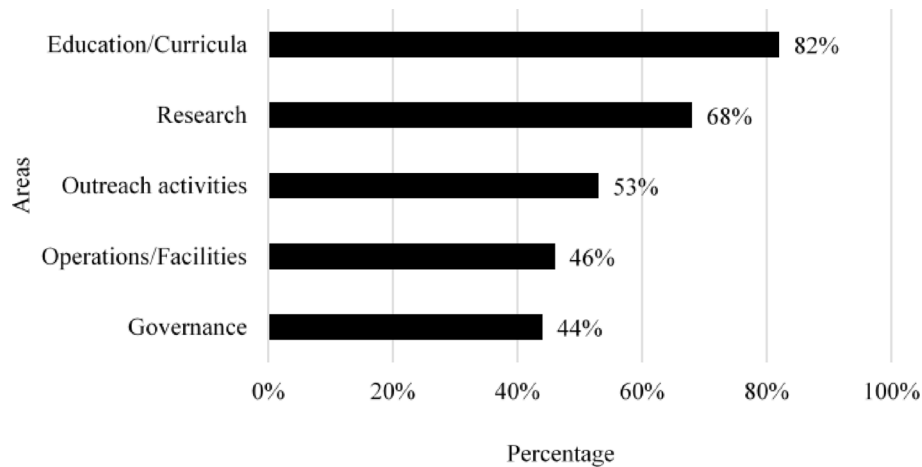
The respondents were distributed across the six continents and 52 countries, showing a remarkable international reach and thus potentially enriching the collected data with diverse insights. The majority were affiliated with European HEIs (46%, 17 countries), followed by Asian (16%, 20 countries), North American (14%, five countries), African (13%, 12 countries), South American (4%, two countries), and Australian HEIs (6%, one country). Also, two HEIs were from countries that belong to both Asia and Europe (2%).

The majority of respondents were affiliated with institutions in the Global North (Table 4), which may partly reflect persistent inequalities in digital infrastructure and access to online education. In many Global South regions, especially rural areas, limited access to computers and reliable internet continues to constrain the expansion of DL [72, 73]. This structural gap influences not only the development of DL-HEIs but also their visibility and participation in global sustainability initiatives.

### 3.2.2 General approaches to sustainability in DL-HEIs

This sub-section addresses the general approaches employed to promote sustainability within DL-HEIs. In a comprehensive analysis of responses regarding sustainability issues and the integration of SDGs, a significant majority of the respondents indicated that these issues were part of their institution's commitment or practices to a great to moderate extent (49% and 31%, respectively). Still, 16% perceived that the integration of sustainability and SDG issues was little, and 4% reported them to be "not at all" integrated into their institutional practices.

Figure 1 shows the areas where sustainability is most prominently embedded within their institutions, from the perspective of the whole-institution approach [59, 74, 75]. This approach considers sustainability across multiple institutional dimensions to ensure holistic integration and is widely recognized as a validated framework for HEIs,



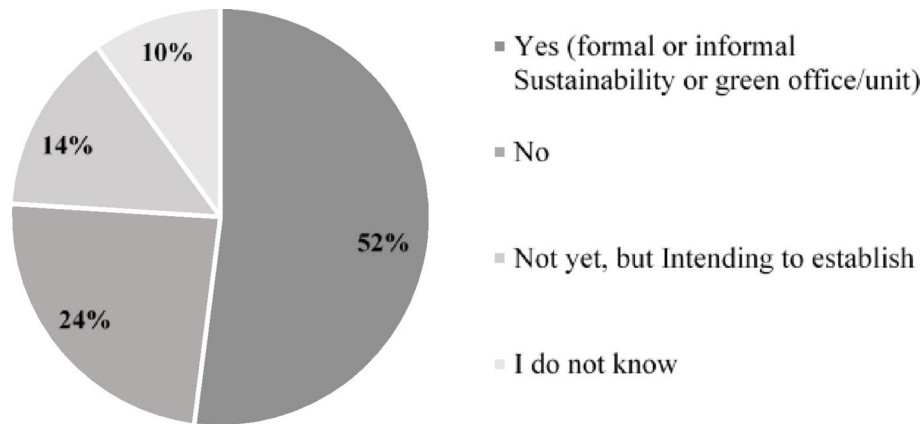
**Fig. 1** Areas in which sustainability is incorporated into DL-HEIs  
(Source: prepared by the authors)

including in the UNEP Sustainable University Framework [59]. The five key dimensions are: (i) Educational area (curricula)—integrating sustainability into courses, teaching activities, and learning outcomes to build knowledge and skills; (ii) Research activities—conducting sustainability-focused research and promoting knowledge creation on sustainability; (iii) Operational activities—managing campus operations and infrastructure to reduce environmental impacts, including energy, water, waste, and sustainable mobility; (iv) Governance—embedding sustainability into institutional policies, strategies, and decision-making to ensure long-term commitment; and (v) Outreach and community engagement initiatives—involving students, staff, and external communities in sustainability programs, partnerships, and participatory projects.

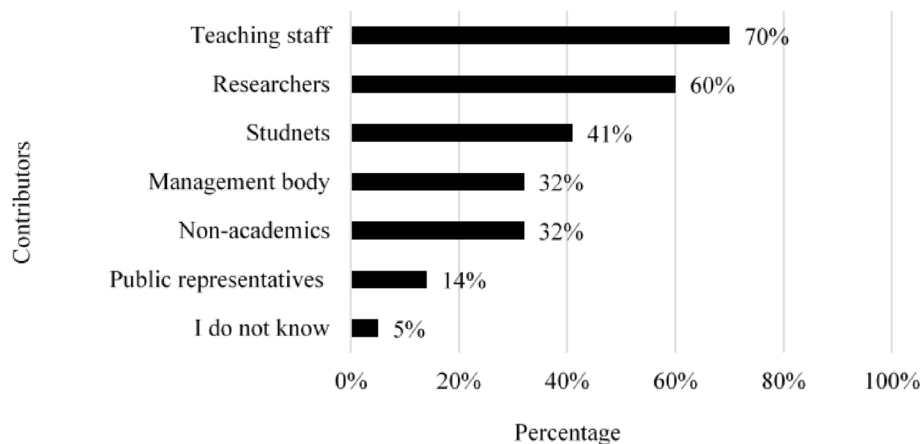
Based on the responses, the educational area (curricula) was reported as a primary area of integration (82%), followed by research activities (68%) and outreach and community engagement initiatives (53%). In comparison, incorporating sustainability into operational facilities and governance was reported to be less predominant (44% to 46%).

These results reveal notable differences when considering the categories outlined in a whole-institution approach to sustainability in HEIs [59, 74, 75]. While operational issues and governance remain the most implemented categories for addressing sustainability and the SDGs in HEIs assessment tools [75, 76], a different trend emerges in the context of DL-HEIs. In DL-HEIs, operational and governance concerns receive less emphasis than other elements of the whole-institution approach (however, it is still a reasonable rate; see Fig. 1), likely due to the limited physical infrastructure typically associated with DL-HEIs. This shift highlights that education and research—considered critical fields of action and essential functions of HEIs [77]—are given greater attention. The advanced technologies utilised by DL-HEIs facilitate the delivery of courses/training and the execution of research projects globally through online platforms, leading to higher ratings in these areas. This aligns with the insights of Nyarko et al. [2], which stated that the primary role of DL-HEIs is to extend educational opportunities to individuals who may not have access to traditional academic settings.

Notably, some previous studies have merged the definitions of governance and operations. For instance, Ceulemans et al. [78] describe operations as encompassing all organisational activities that support the creation of higher education services—e.g., student



**Fig. 2** Existence of sustainability or green offices/units across DL-HEIs (Source: prepared by the authors)



**Fig. 3** Main contributors to promoting sustainability in DL-HEIs (Source: prepared by the authors)

administration, planning, accounting, facility management, and human resource management, among others—which may contribute to differing interpretations of sustainability implementation in various elements.

Figure 2 shows the existence of sustainability or green offices/units across the Institutions. The majority (52%) of HEIs have a sustainability (or green) office, and a minority (14%) intend to establish it. Still, nearly one-quarter of the institutions (24%) need to establish a sustainability office (or similar).

As shown in Fig. 3, the main contributors to promoting sustainability within DL-HEIs are perceived to be the teaching staff (70%) and the researchers (60%). Students also represent a substantial portion of these contributors, with 41% acknowledging their role in advancing sustainability efforts in their institutions. Other groups, including management bodies (32%), non-academic staff (32%), and public representatives (such as Non-Governmental Organisations (NGOs) or external groups) (14%), are recognised for their contribution, although to a lesser extent.

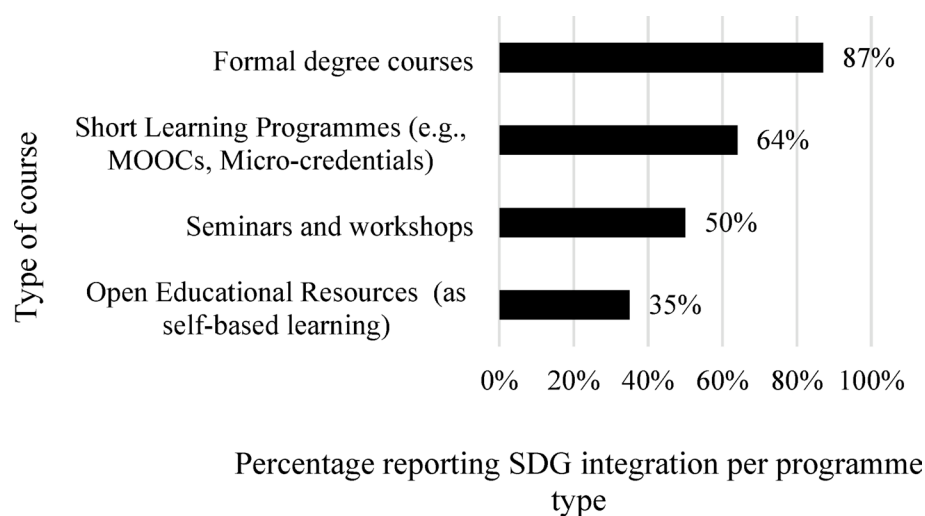
Engaging the broader academic community, particularly non-academic staff, in sustainability initiatives is essential for fostering a culture of sustainability, especially within DL-HEIs. As these institutions heavily rely on online processes, non-academic staff

provide valuable technical expertise and critical support, which is fundamental for successfully implementing sustainability practices and initiatives. Prior studies (e.g., [79, 80]) support this perspective, highlighting the significant role of non-academic staff as critical contributors to driving sustainability changes within HEIs.

### 3.2.3 Approaches to teaching SDGs in DL-HEIs

This sub-section reveals the approaches DL-HEIs employ to integrate the SDGs into the teaching framework of their institutions. Overall, most respondents (70%) affirmed that their institutions developed courses specifically addressing topics related to the SDGs. One-fifth of participants (20%) indicated that such courses were not offered, while 10% were unsure. Among those who confirmed the development of SDG-related courses, an open-ended question requested the names of these courses (with 60 responses). They listed several courses such as Environmental Studies, Corporate Social Responsibility, Circular Entrepreneurship, Carbon Literacy Training, Leadership for SD, Poverty and Food Security, SDGs, Climate Issues, Health and Sanitation, Sustainability Education and Learning, Transdisciplinary Practice for Sustainability, Sustainable Cities and Communities, and Sustainable Business in a Global World. Figure 4 shows the type of educational programmes at the institution where the topics related to SDGs are taught, based on only respondents who indicated that their institution offers SDG-related courses. These respondents were asked to indicate all programme types where the SDGs are integrated, allowing multiple selections. The figure thus presents the proportion of respondents reporting each type, including formal degree courses (87%), short learning programmes (64%, such as MOOCs and Micro-credentials), seminars and workshops (50%), and Open Educational Resources for self-paced learning (35%).

The primary fields incorporating SDG-related courses are Biological, Natural, Agricultural, or Environmental Sciences (53%), Social Sciences, Business (46%), Education (41%), and Engineering and Technology (36%). To a lesser extent, other fields also include sustainability and SDG content, among them Humanities (30%), Physical Sciences, Mathematics and Computer Science, Communication, Media and Public Relations (24%), Medical and Health Sciences (20%) and Arts (12%).

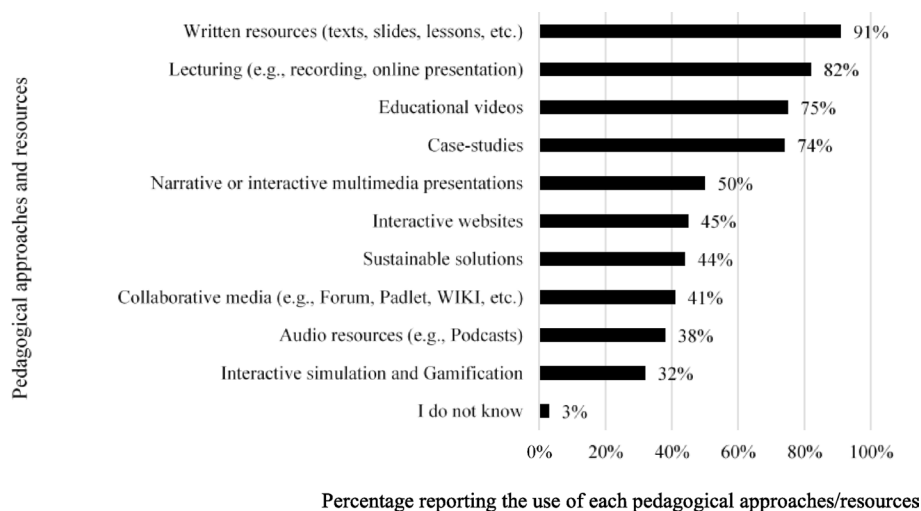


**Fig. 4** SDGs educational programmes at DL-HEIs  
(Source: prepared by the authors)

This variety in incorporating SDGs-related topics across diverse programmes in DL-HEIs demonstrates the interdisciplinary nature of sustainability topics, reflecting Annan-Diab and Molinari's [81] study that similarly emphasises that SD spans a broad spectrum of disciplines -such as Environment, Biology, Medicine, Nutrition, Agronomics, Geography, Engineering, Architecture, Sociology, Psychology, Law, Economics, and Business. The results align with this interdisciplinary perspective, demonstrating that while SDG-related topics are already incorporated into various fields, there remains a greater focus on natural and environmental sciences. Therefore, a more comprehensive and collaborative educational approach should be adopted within DL-HEIs across their different disciplines.

The learning pathways used for teaching the SDGs in the above-mentioned education programmes were mainly in the mixed format, including both synchronous and asynchronous moments (60%) and, to a lesser extent, the asynchronous (14%) or the synchronous (11%) formats. This approach perfectly aligns with the conclusions drawn by Perbandt et al. [44], who also conducted their research within DL-HEIs and suggest that employing diverse tools and approaches in e-learning courses—by effectively combining both synchronous and asynchronous elements—is essential in DL, resulting in acquiring in-depth knowledge on course topics.

Regarding pedagogical approaches and resources used for SDGs teaching in the DL-HEIs (Fig. 5), respondents who indicated that their institution offers SDG-related courses were asked to select pedagogical approaches and resources that applied to SDGs teaching in their institution, allowing multiple selections. Figure 5, therefore, presents the proportion of respondents reporting the use of each approach/resource. The predominant approaches include written resources (e.g., texts, slides, lessons, etc.) (91%), followed by lecturing (e.g., recording, online presentation by a professor or a guest speaker) (82%), educational videos (75%) and case studies (74%). These approaches and resources reflect a more traditional learning pathway. In contrast, more innovative and interactive approaches such as narrative or interactive multimedia presentations, interactive websites, sustainable solutions, collaborative media (e.g., Forum, Padlet, WIKI, etc.), audio resources (e.g., Podcasts), interactive simulation and Gamification, and I do not know.



**Fig. 5** Applied pedagogical approaches and resources at DL-HEIs (Source: prepared by the authors)

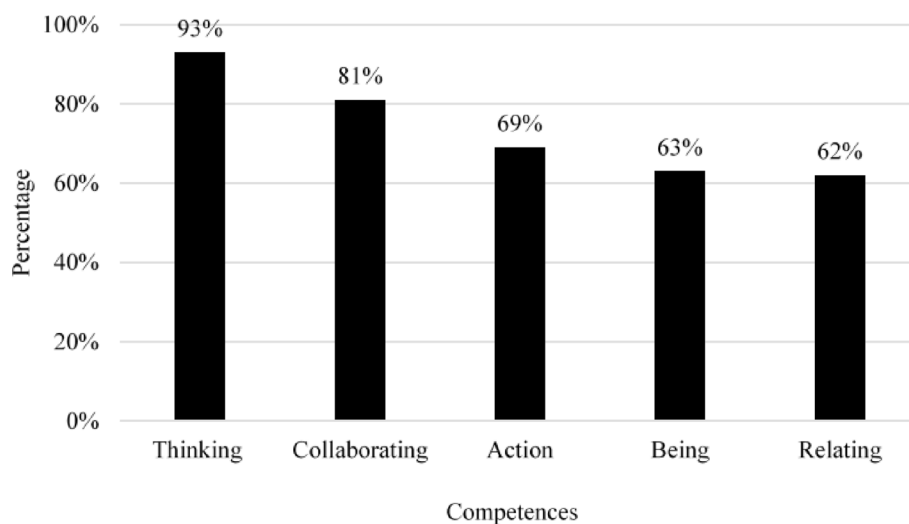
etc.), audio resources (e.g., podcasts), interactive simulation, and gamification, ranging from 32 to 50%.

While the results reveal a predominant focus on written materials, a shift toward more interactive, innovative resources is essential to fully leverage the interactive potential of online technologies accessible in DL-HEIs since digital platforms can enhance engagement and support self-regulated learning by facilitating interaction and collaboration [36]. The results also highlight the need to invest more in approaches such as gamification, multimedia presentations, and interactive simulations to offer distance learners hands-on experiences to make complex sustainability issues more engaging. This shift could enrich the DL experience, aligning with findings by Aparicio et al. [82] and Azeiteiro et al. [6], who highlight that interactive methods improve motivation and engagement with sustainability topics.

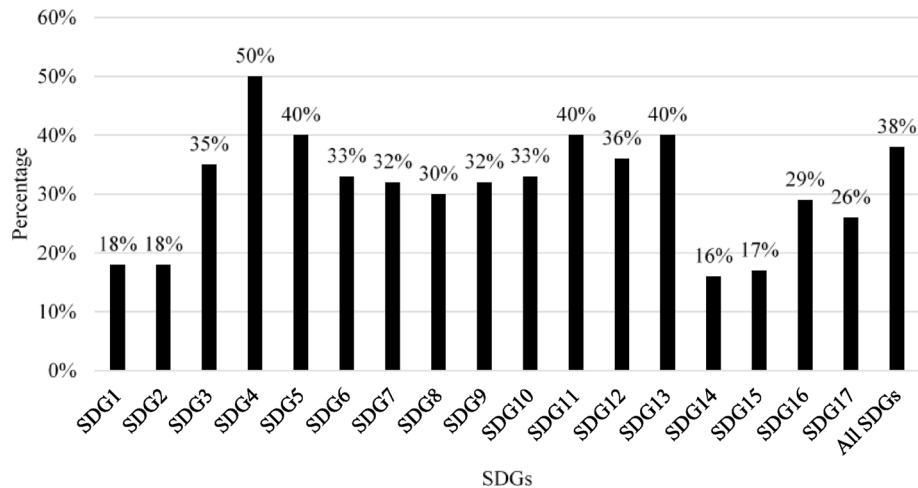
Relating to the assessment aspects of teaching SDGs, the most applied tools included exams, short quizzes, discussion forums, presentations (both oral and poster) and assignments/projects (paper-based or digital) ranging from 60 to 70%. However, alternative assessment methods such as self-assessment tools, portfolios, peer reviews (assessment by learners), and assessments based on hours of participation (e.g., certificate of participation by hours) were applied by DL-HEIs, but to a lesser extent (41 to 25%).

Regarding the competencies, as shown in Fig. 6, the courses were designed with the expectation that they would foster a range of competencies based on the Inner Development Goals Framework [33], which included essential competencies to attain sustainability, namely: (i) Thinking (cognitive skills) such as critical thinking, complexity awareness, and perspective skills (93%), (ii) Collaborating (social skills) which encompasses communication, co-creation, and mobilisation (81%); (iii) Action (enabling change) including courage, optimism, creativity, and perseverance (69%), (iv) Being (relationship to Self) characterised by inner compass, integrity and authenticity, self-awareness, and presence (63%) and (v) Relating (caring for others and the world) such as appreciation and being connected to others and the biosphere (62%).

This strong emphasis on thinking skills highlights the need for learners to address the diverse challenges of sustainability effectively. This focus is consistent with the



**Fig. 6** Inner development competencies to attain sustainability at DL-HEIs (Source: prepared by the authors)



**Fig. 7** Areas of the SDGs mainly covered by courses/educational programmes at DL-HEIs (Source: prepared by the authors)

GreenComp competencies framework [60], which introduced embracing complexity as one of the core categories. It demonstrates the importance of developing both systemic and critical thinking skills.

As shown in Fig. 7, the responses regarding the SDGs covered within education programmes reveal that the most frequently addressed goal is SDG4 (Quality Education), with 50% of respondents indicating its inclusion within their institutions' courses and educational programmes, followed closely by SDG5 (Gender Equality), SDG11 (Sustainable Cities and Communities), and SDG13 (Climate Action) all receiving 40% inclusion in DL-HEIs courses. Other prominent goals include SDG12 (Responsible Consumption and Production, 36%) and SDG3 (Good Health and Well-Being, 35%).

Despite these results, some SDGs need more integration in educational programmes at DL-HEIs. For instance, SDG1 (No Poverty) and SDG2 (Zero Hunger) were each cited by only 18% of participants, while SDG14 (Life Below Water) and SDG15 (Life on Land) received minimal attention at 16% and 17%, respectively. The interesting point is that 38% of respondents indicated that all SDGs are integrated into their educational programmes. This reflects a significant effort to adopt a holistic approach to education for sustainability, emphasising that the SDGs should be viewed as interconnected frameworks rather than isolated objectives [83]. These results underscore the importance of a balanced focus on all SDGs within DL-HEIs to enhance the effectiveness of sustainability education and effectively contribute to achieving the goals outlined in Agenda 2030.

Across our sample, SDG 4, SDG 5, and SDG 13 appear most frequently because DL-HEIs act primarily through their core academic functions, curriculum and research, which receive greater emphasis than operations and governance in these digitally native settings. This places Quality Education (SDG4) at the centre of institutional missions. Also, Gender Equality (SDG5) is widely mainstreamed in higher education agendas and easily integrated into online courses, and Climate Action (SDG13) content is abundant and adaptable to MOOCs [37] and mixed learning pathways. By contrast, goals that depend more directly on campus infrastructure and energy systems tend to be less visible in DL, which helps explain the lower representation of SDG 7. Inequality is often tackled through access, inclusion, and lifelong learning commitments at the institutional level rather than through discrete course mapping, which may contribute to a

comparatively lower share for SDG 10. The disciplinary profile of offerings also matters, since many SDG-related courses cluster in natural and environmental sciences, reinforcing the observed emphasis.

#### **3.2.4 Challenges, drivers, and future perspectives**

This study also identified several barriers that DL-HEIs face in integrating the SDGs into their educational programmes. Among the identified barriers at DL-HEIs, the most prominent were the lack of financial resources, and the limited institutional awareness, concern, or priority relating to SDG issues (52% each). Two other barriers considered important for SDG integration in curricula were the lack of expertise in online curriculum design specific to SDGs (41%) and the need for more support from the leadership and administrative bodies (36%). Other barriers, less frequently indicated, included the lack of educators in the area of SDGs or DL, as well as the lack of interest from staff or technical support (e.g., instructional designers) for implementing the courses on online platforms (31–35%), and finally, the inherent complexity of SDGs to be applied in DL (23%).

Regarding the drivers and efforts behind implementing sustainability initiatives and SDGs in DL-HEIs, most respondents highlighted the importance of having an institutional sustainability policy and self-commitment (70%), followed by the need for research and funding opportunities, as well as social and global responsibility (60% each). Other drivers identified by the respondents were partnership collaboration opportunities (e.g., with other HEIs, NGOs, etc.) (52%), learners' demand (48%), infrastructure availability (41%), and the existence of an HEI ranking system based on SDGs (33%), e.g., Times Higher Education (THE) impact Ranking [84] or STARS [71].

Finally, looking ahead to 2030, most respondents anticipated significant progress in implementing sustainability initiatives and SDGs within their institutions (62%, to a great or very great extent). Meanwhile, 27% expected moderate progress, and 9% foresaw only limited advancements; just 2% expected no change would occur (2%).

In response to the open question on SDG teaching at DL-HEIs or sustainability more broadly, participants identified several challenges and proposed corresponding solutions. A key issue raised was ensuring inclusivity for all students, particularly distance learners who often balance part-time jobs alongside their studies, limiting their capacity for full engagement [see also 5–9]. To overcome these challenges, respondents suggested stronger institutional support, increased scholarships and funding opportunities, and more meaningful integration of sustainability-related skills into curricula. Additionally, they emphasised the importance of improving digital tools and skills, as DL heavily relies on technology. A notable benefit of SDGs courses in DL mode mentioned by the respondents was the opportunity for learners to participate in global courses. This participation would allow learners to engage more fully with those from diverse educational and professional backgrounds and experiences, thus enriching their learning journey.

Emerging 2025 studies show that online and hybrid formats can expand sustainability and SDG-related competencies, for example, COIL experiences that foster intercultural collaboration, and virtual labs that widen access in resource-constrained contexts while exposing capacity gaps [85]. Program-level applications that quantify curriculum contributions to specific SDGs, reported in 2024, offer practical templates DL-HEIs can adapt [86].

#### 4 Conclusions

This paper has shown that DL-HEIs worldwide enhance education access and allow a broader demographic to engage with the SDGs. This accessibility is vital for promoting awareness and understanding of the SDGs among diverse communities. These institutions are critical in equipping learners with the necessary skills to contribute to the SDGs. The results show that sustainability efforts are primarily integrated into the curriculum, followed by research activities (with teaching staff and researchers as the main contributors). Offering targeted programmes that align with the SDGs prepares students to tackle global challenges such as poverty, inequality, and climate change. DL may also foster international collaboration and knowledge sharing. DL-HEIs can connect students and educators from different regions, promoting a global perspective on sustainability and encouraging collective action towards the SDGs.

The flexibility of DL also allows individuals to balance education with other commitments, making it easier for working professionals and those in remote areas to pursue studies related to the SDGs. Moreover, the case studies show that technology in distance education encourages innovative teaching methods that can enhance engagement and understanding of complex sustainability issues. This can lead to more effective learning outcomes and a more profound commitment to the SDGs.

While DL has many benefits towards implementing SDGs, there are challenges, such as digital divide issues, varying levels of institutional support, and the need for continuous improvement in curriculum design to address the SDGs effectively. In terms of recommendations for policy-makers and educational institutions, the contribution of DL to the SDGs may be enhanced by (i) increasing funding for technology access, (ii) developing partnerships with local communities, (iii) integrating sustainability into all aspects of higher education, and (iv) incorporate community-based projects that allow students to apply their learning in real-world contexts, thereby fostering a sense of responsibility and active participation in SD efforts.

In terms of recommendations for policy-makers, there is a clear need to support DL-HEIs in promoting the SDGs through targeted actions. For example, funding streams could be established to develop SDG-focused online courses and to train educators in sustainability teaching. Support is also needed in creating a clear framework for recognising and accrediting SDG-related learning outcomes, which may motivate more institutions to engage actively. Furthermore, policies should encourage partnerships between DL-HEIs, traditional HEIs, and industry, at both national and international levels, to enhance content quality and facilitate the sharing of best practices. Finally, incorporating SDG-related metrics into national quality assurance standards for online education would help ensure that these institutions are accountable for their contributions to the 2030 Agenda.

This study has several limitations that inform the interpretation of our results. The survey relied on self-reported information from faculty and staff at DL-HEIs that actively pursue the SDGs, which may introduce selection and social desirability biases and may overstate the extent of SDG integration, particularly in teaching-related activities captured by our instrument. Participants were recruited through purposive, snowball, and opportunistic methods in the absence of a comprehensive global DL-HEI database, which can privilege better-connected institutions. Although the sample spans 52 countries, responses were unevenly distributed across regions, with a higher share

from Europe, which may limit generalisability to underrepresented areas. Differences in institutional capacity and digital infrastructure, more acute in parts of the Global South, may also affect both participation and the types of practices reported. In addition, the case study set was limited to institutions with peer-reviewed documentation, which can bias examples toward more visible or research-active DL-HEIs. Finally, data collection occurred from November 2023 to January 2024, therefore, the results reflect that period.

#### Abbreviations

<b>DL</b>	Distance learning
<b>DL-HEI</b>	Distance learning higher education institutions
<b>EVS</b>	European virtual seminar
<b>HEI</b>	Higher education institution
<b>IBL</b>	Inquiry-based learning
<b>LMS</b>	Learning management systems
<b>MOOC</b>	Massive open online course
<b>MMRs</b>	Multimedia Resources
<b>NGO</b>	Non-governmental organisation
<b>ODL</b>	Open and distance learning
<b>SD</b>	Sustainable development
<b>SDGs</b>	Sustainable development goals
<b>WBL</b>	Work-based learning
<b>WIL</b>	Work-integrated learning

#### Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1007/s43621-025-02319-x>.

Supplementary Material 1

#### Author Contribution

Walter Leal Filho: Conceptualisation, Methodology, Writing – original draft, Writing – review & editing, Supervision. Mahsa Mapar: Methodology, Investigation, Formal analysis, Visualisation, Writing – original draft, Writing – review & editing, Project administration. Laís Viera Trevisan: Investigation, Formal analysis, Visualisation, Writing – original draft, Writing – review & editing. Sandra Caiero: Investigation, Formal analysis, Visualisation, Writing – original draft, Writing – review & editing. Rudi W. Pretorius: Investigation, Formal analysis, Writing – original draft, Writing – review & editing. Melanie D. Nicolau: Investigation, Formal analysis, Writing – original draft, Writing – review & editing. Paula Bacelar-Nicolau: Data curation, Investigation, Formal analysis, Visualisation, Writing – original draft, Writing – review & editing. Wim Lambrechts: Investigation, Formal analysis, Writing – original draft, Writing – review & editing.

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#### Data availability

Due to the sensitive nature of the questions asked in this study, specifically involving the names of institutions and educational programmes or courses, survey respondents were assured that raw data would remain confidential and would not be shared. As such, the research data supporting this study are not publicly available.

#### Declarations

##### Ethics approval and consent to participate

The nature of the research, the methods used, and the fact that no personal data was stored or can be traced back to individuals, conforming with General Data Protection Regulation (GDPR) standards, means that the study is not subject to an ethics permit, as specified by the Association of Medical Ethics Committee in Germany, the body responsible for such assessments in the country leading this study. In any case, and considering any argument requesting waiving consent, all respondents willingly agreed to participate in the study, confirmed through an additional question added to the beginning of the questionnaire, presenting options for yes or no. All methods were carried out in accordance with relevant guidelines and regulations. Participation in the study was voluntary and anonymous. Respondents were informed about the purpose of the study and gave their consent by proceeding with the survey.

##### Consent to publication

All participants were informed about the purpose of the study and provided consent for the anonymous data collected through the survey to be used in internal reports and academic publications as well as website/social media posts. No identifiable personal data or images are included in this manuscript.

##### Competing interests

The authors have no relevant financial or non-financial interests to disclose.

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