



TECHNICAL UNIVERSITY OF CLUJ-NAPOCA

ACTA TECHNICA NAPOCENSIS

Series: Applied Mathematics, Mechanics, and Engineering

Vol. 69, Issue II, June, 2026

THE ROLE OF SUSTAINABLE DEVELOPMENT GOAL 4 IN INTEGRATION OF EDUCATION FOR SUSTAINABLE DEVELOPMENT IN HIGHER EDUCATION

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Abstract: Higher education is an initiator of change in society and therefore it is in a position to contribute to increasing institutional and societal sustainability. For this, it is necessary that all higher education, regardless of the field of study, integrates Education for Sustainable Development into the curriculum through which both Sustainable Development Goal 4 and the other Sustainable Development Goals can be achieved.

Keywords: higher education, Education for Sustainable Development, Quality Education, Sustainable Development Goals, Sustainable Development Goal 4.

1. INTRODUCTION

The ever-changing society constitutes a continuous challenge for higher education (HE), which can be compared to “a manufacturing company that produces educational services” [1]. Like a company, to develop and be relevant in society, it must be flexible, adaptable, an initiator of change and constantly open to the new. HE is a public good, but also a private one, being indispensable in the processes of social and economic development, as well as in the processes of personal development and well-being [2], playing a particularly important role in raising people's awareness of the relevance of the efficient and conscious use of resources and the ecological culture of the population [3].

HE is an initiator of change because it “carries out scientific research, provides solutions to the problems facing countries, trains a skilled workforce in the necessary fields, and plays a leading role in the development of democratic principles and free thought” [4] and “bears a profound, moral responsibility to increase the awareness, knowledge, skills, and values needed to create a just and sustainable future” [5, p. 17].

Just as “organizations that recognize the importance of sustainability and adopt appropriate practices can achieve significant improvements in their performance and become more attractive to investors” [6, pp. 53-54], HE must also play an important role in increasing institutional sustainability, improving educational performance, enhancing research quality, and making innovation “green”.

HE, as a trainer of future specialists, provides the appropriate knowledge, skills, abilities and experiences that enable students to acquire critical awareness, self-actualization, social justice and economic growth [7] and “equip them with tools and knowledge that allow them to have a broad and holistic understanding of the complex situations they will face after graduation. Sustainable development skills are part of what they need to learn” [8].

The goal of Education for Sustainable Development (ESD) is to develop skills that help people analyze their actions while constantly considering both the current situation and the future social, cultural, economic and environmental impact, from both a local and global perspective and all HE should integrate ESD into the curriculum.

The SDGs represent “the commitment [...] of countries around the world [...] to wisely guide the behavior of human beings to ensure equal human dignity, with a knowledge-based strategy that provides for comprehensive and sustainable human development for all (food, water, health, environmental care and education)” [9]

ESD and education (in general) are very important in achieving the SDGs and are found in SDG 4: Quality Education, Target 4.7 which aims that “by 2030, all learners acquire the knowledge and competences necessary to promote sustainable development, including, inter alia, through education for sustainable development and sustainable lifestyles [...]” [10]. SDG 4 has a double meaning being both a goal and an instrument of social transformation necessary to achieve the other objectives by acquiring skills, attitudes and behaviors that guide towards a sustainable future [11]. The SDGs have “ambitious targets for academia worldwide [...] for many universities, achieving a higher position in impact rankings is a necessity to be competitive” [12] and contribute to creating a mindset that favors the dissemination of the SDG principle through research, learning and teaching, operations and governance and leadership [13, 14] (Fig. 1).

Through a literature review, a gap was identified in the analysis of the role that SDG 4: Quality Education plays in integrating ESD into higher education. Through the analysis conducted within the framework of this research, the authors aimed to clarify and explore the connection between SDG 4, ESD and higher education.

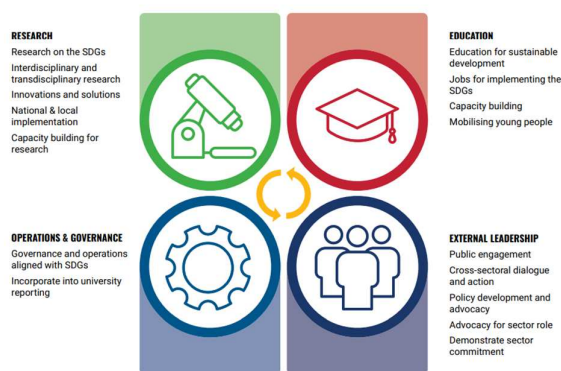


Fig. 1. The contribution of universities to the SDGs.
(Source: [14])

2. RESEARCH PURPOSE AND OBJECTIVES

The paper aims to analyze, through bibliometric analysis, the role that SDG 4 plays in integrating ESD in HE. For this, the following objectives were set:

- Identify the need to adopt the SDGs to increase the quality of education;
- Explore the relationship between HE, ESD and SDG 4;
- Highlight trends in SDG 4.

3. RESEARCH METHODOLOGY

To achieve the proposed objective, a bibliometric research was conducted using the VosViewer program.

4. RESULTS AND DISCUSSION

4.1 Bibliometric analysis

We used the Web of Science Core Collection (WoS) database to perform the bibliometric analysis, because “WoS is a reliable and robust source of bibliometric data” [15]. The research was conducted between July and August 2025, and the search was of Boolean type using the syntax: “*education for sustainable development*” AND “*higher education*” OR “*higher educations*” AND “*sustainable development goal 4*” OR “*SDG 4*” OR “*SDG 4: Quality Education*”.

The syntax used was composed of the junction of three topics:

- Topic 1: “education for sustainable development”;
- Topic 2: “higher education” OR “higher educations”;
- Topic 3: “sustainable development goal 4” OR “SDG 4” OR “SDG 4: Quality Education”.

This resulted in 1,789 documents. A single filter was used, for the English language, obtaining 1,707 documents that represented our bibliometric research sample.

The resulting documents belong to several WoS domains. Fig. 2 shows the top 10 WoS domains where the research articles are published.

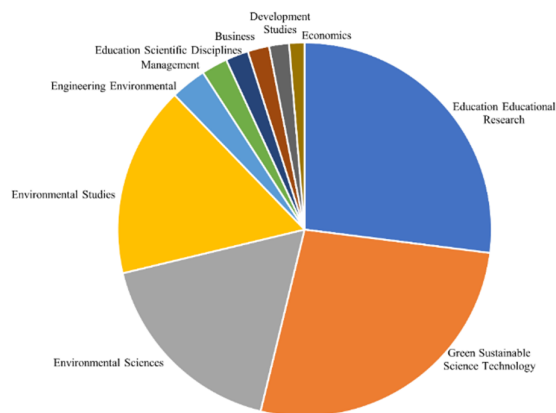


Fig. 2. Top 10 WoS domains of documents in the research sample.

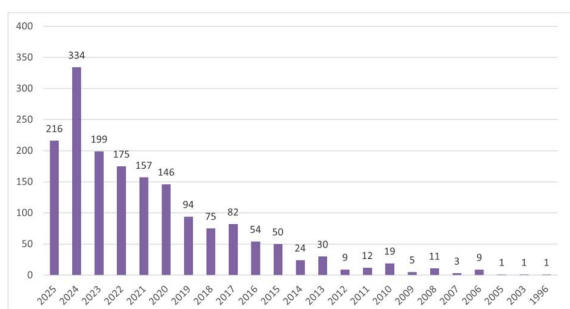


Fig. 3. Distribution by year of documents in the research sample.

The documents in the research sample were published and indexed between 1996 and 2025. It is observed that starting with 2015 the number of documents began to increase, reaching a peak in 2024 when most works were published and indexed: 334 (Fig. 3). The documents in the research sample are of the type articles, proceedings papers, books, etc. (Fig. 4). From the figure the number of articles was over 10 times higher than the “proceedings paper” in the next place. As previously mentioned, the VOSViewer program was used for bibliometric analysis. With its help, the sample of 1,707 documents was processed.

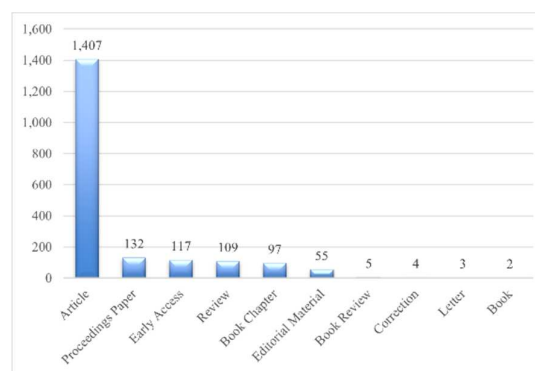


Fig. 4. Type of documents in the research sample.

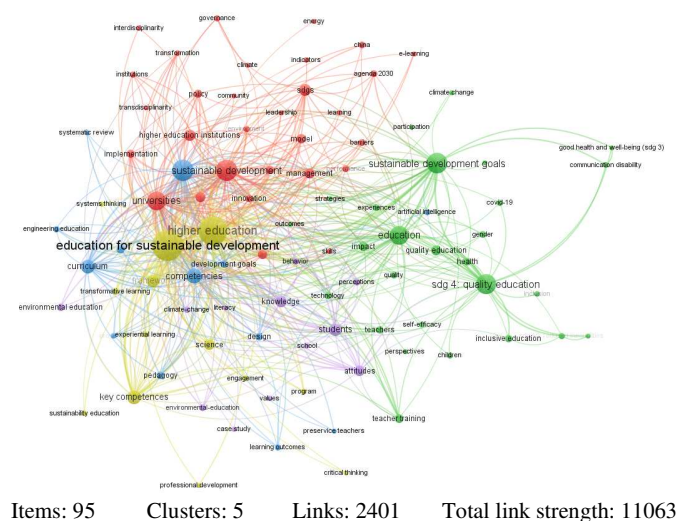


Fig. 5. The connection between research topics after filtering.

Choosing 5 as the minimum number of occurrences of a keyword resulted in 388 words that met this criterion, distributed into 10 clusters. After filtering, 15 was chosen as the minimum number of occurrences of a keyword,

resulting in 95 keywords distributed in 5 clusters. Fig. 5 shows the connection between the three topics after filtering with 15 as the minimum number of occurrences of a keyword.

Looking at Fig. 5, it is observed that there is a strong connection between “education for sustainable development” and “higher education” due to the interest of the academic community in these two topics. There are also stronger or weaker links between “education for sustainable development” and “universities”, “teaching training”, “behavior”, “experience”, “quality education”, “competencies”, “experimental learning”, and “implementation”. This is because, over time, there has been a fluctuation in the themes associated with ESD, depending on the socio-economic context and the concerns of researchers. The keywords found in at least 100 documents in the research sample are presented in Table 1.

From Table 1, two of the topics of interest for our research, “education for sustainable development” and “higher education”, are in the first two places with an appearance in over 500 documents in the research sample. The third topic, “sdg 4: quality education”, is in 6th place with an appearance in 240 documents in the same sample.

Table 2 shows the keywords in the research sample that have a Total Link Strength of over 500. Total Link Strength indicates the total strength of an element's links to other elements. The higher its value, the stronger the links.

Table 1
Keywords found in at least 100 documents in the research sample.

Keyword	Occurrences
education for sustainable development	574
higher education	507
sustainable development	281
sustainability	266
sustainable development goals	253
sdg 4: quality education	240
universities	221
education	219
competencies	134
key competences	120
curriculum	117

Table 2
Keywords from the research sample that have Total link strength over 500.

Keyword	Total link strength
education for sustainable development	1,959
higher education	1,933
sustainability	1,064
universities	1,027
sustainable development	1,020
sustainable development goals	737
competencies	677
education	660
key competences	580
curriculum	558
sdg 4: quality education	551

Again, “education for sustainable development” and “higher education” are in the top two places with a Total link strength value of over 1,900. The third topic, “sdg4: quality education”, is in 11th place with a Total link strength value of only 551. Comparing Tables 1 and 2, it is noted that the keywords are the same, the order is different.

As can be seen in Fig. 6, in the researched works, the topic “higher education” is in cluster 4, appears 507 times in the documents in the sample, and the Total link strength is 1933. It also has links with “sustainable development”, “sustainable development goals”, “education for sustainable development”, “sdg 4: quality education”, “development goals”, “higher education institutions”, “management”, “leadership” etc. These links derive from the fact that researchers' interest has resulted in published articles containing these keywords.

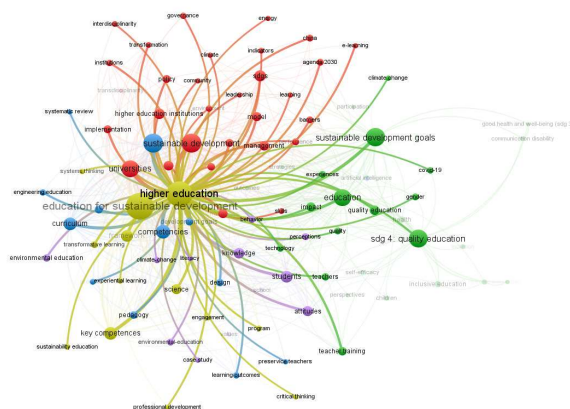


Fig. 6. Higher education network.

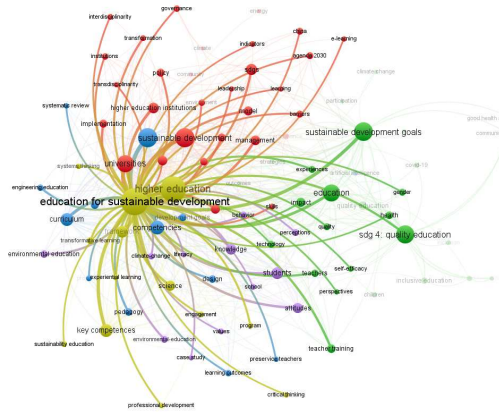


Fig. 7. Education for sustainable development network.

Regarding the topic “education for sustainable development” (Fig. 7), it is also in cluster 4, close to the topic “higher education”. It has the highest number of occurrences in documents (574) and the highest Total link strength (1959). It has links with “higher education”, “sdg 4: quality education”, “education”, “sustainable development”, “knowledge”, “sustainable development goals”, “competences”, “environmental sustainability”, “management”, “leadership” etc. The resulting links show that ESD is becoming part of the activities and actions carried out in higher education, becoming a major and constant concern in this field. The result of these concerns has been reflected in the publication of articles.

The last topic, “sdg 4: quality education” (Fig. 8) is in cluster 2, Total link strength is 551 and appears 240 times in the documents in the sample. From the total number of links, it is observed that “higher education”, “education for sustainable development”, “education”, “knowledge”, “sustainable development”, “sustainable development goals”, “SDG 3: Good health and well-being”, “management”, etc. The links identified in the analysis show that there is a connection between “SDG 4: Quality Education” and the other SDGs, mainly “SDG 3: Good health and well-being”, in the published articles. This can be explained by the increasing interest of the academic community in analyzing the relationships between the SDGs.

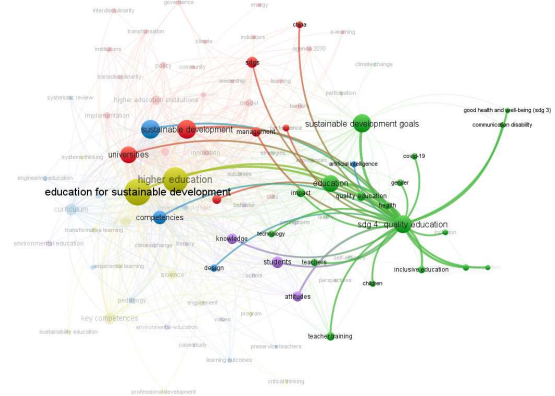


Fig. 8. SDG 4: Quality Education network.

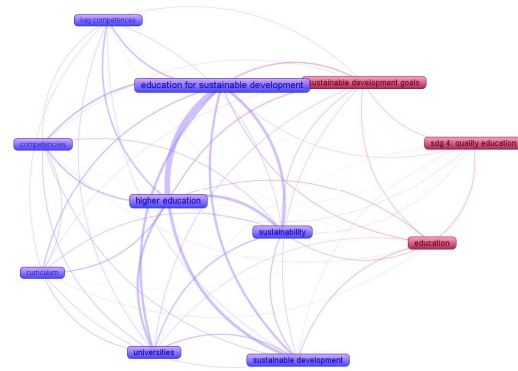


Fig. 9. Connections between topics.

For a better visualization of the existing links between the three topics, a representation was created using the first 11 keywords from the database used, words that have a Total Link Strength of over 500. 2 clusters were obtained, one with 8 items and one with 3 items (Fig. 9).

Analyzing Fig. 10, it is observed that between topics “higher education” and “education for sustainable development” there are the strongest links (Link strength: 274). This is because these two topics have been studied extensively by researchers, resulting in many scientific articles.

The links with the topic “sdg 4: quality education” are not so strong: Link strength 21 in the case of “education for sustainable development” (Fig. 11) and Link strength 16 in the case of “higher education” (Fig. 12). One explanation for the weaker links may be that the SDGs have only recently come to the attention of higher education researchers, who have focused more on the link between “education for sustainable development” and “higher education”.



Fig. 10. The connections between the topics “higher education” and “education for sustainable development”.

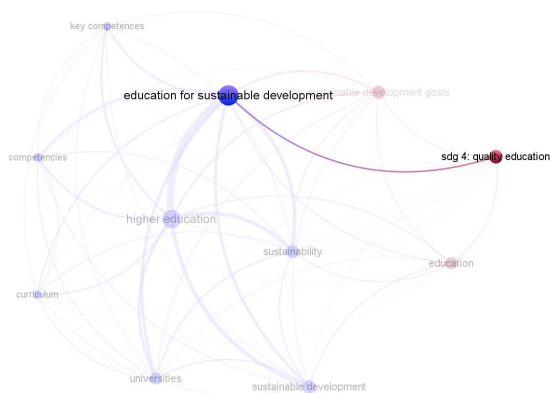


Fig. 11. The connections between the topics “education for sustainable development” and “sdg 4: quality education”.

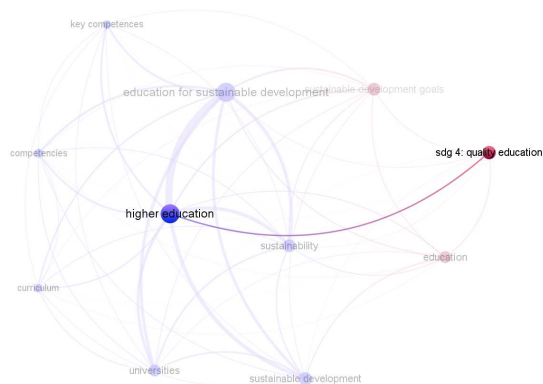


Fig. 12. The connections between the topics “higher education” and “sdg 4: quality education”.

In the documents that formed the basis of our research, the topic “sdg 4: quality education” is more or less strongly linked to other SDGs (e.g., “sdg 3: good health and well-being”, “sdg 5: gender equality”, “sdg 17: partnership for the goals”, “sdg 9: industry, innovations and infrastructure”).

5. CHALLENGES OF IMPLEMENTING SDG 4 AND INTEGRATING ESD INTO HE

The implementation of SDG 4: Quality Education brings new challenges to HE. According to the European University Association [16], HE is an important part of civil society, providing high-quality education, top-level research and original innovation, fulfilling all the SDGs.

As HE is responsible for educating and training future leaders, HE should promote a development model that supports the concept of SD. But the transition of HE towards increased sustainability, improved quality of education and the integration of ESD into teaching is not easy as this approach further highlights the challenges faced by HE institutions that embrace change and transform into sustainable HE institutions.

Among these difficulties, the following are mentioned [17, 18, 19]:

- Lack of adequate funding. Many universities face limited financial resources, making it difficult to invest in technology development and teacher training programs. Without financial resources, it is difficult to ensure quality education.
- Management team lacking vision.
- Lack of cooperation between the management team and teaching staff.
- Lack of adaptability of human resources (teachers, administrative staff) and students to new requirements.
- Lack of qualified personnel and resources.
- Gaps in understanding and appreciating sustainability concepts.
- Disciplines with a reduced number of hours.
- Courses with limited topics or outdated information.
- The refusal of some teachers to integrate sustainability topics into the course(s) they teach.
- The need for interdisciplinary educational frameworks.

Despite these difficulties, HE is making enormous efforts to improve the quality of education and integrate ESD into the

curriculum. The result of these efforts is visible in the professional training of future specialists.

6. CONCLUSIONS

ESD emerged from the realization that only through sustained education will people become aware of the need to adopt responsible and sustainable behavior towards the environment. By integrating ESD into all areas of HE, the importance of sustainability in all areas will increase. Through education, future specialists are given the information, knowledge, skills, and value norms necessary to make correct decisions for a sustainable future. Through research and innovation, techniques and sustainability are developed and their application in practice leads to the growth of sustainability technologies.

The result of education is found in all areas of social life. Therefore, to increase the quality of education at any level, but especially at the university level, it is necessary to have interconnections between all areas. Through the SDGs, these interconnections are achieved. Thus, even if education is a separate objective, it is interconnected with other areas, and the result begins to be visible at the level of society through a greater concern for environmental problems, climate change, reducing resource waste, adopting sustainable behavior, etc.

The concept of ESD has become an integral part of SDG 4 and is in continuous dynamics, and HE – through education, research and innovation, but also through institutional practices that promote sustainability and community involvement – is important in the SD of the community and in achieving the SDGs.

By integrating the SDGs into the strategies of HE institutions, the results are visible in the following plans:

- administrative – resource management, waste reduction and selection, sharing infrastructure, services and facilities with the local community or other universities in the area;

- educational, research and innovation – training well-trained specialists who, in partnership with civil society and the community they are part of, can contribute to the SD of both

the local community and the organizations in which they operate.

A special role in HE will be played by education for the SDGs (ESDGs), which, although based on ESD, directly responds to the growing interest of universities in engaging in achieving the SDGs. Delivering ESGDs demonstrates the importance and impact that HE has on both its existing students and staff, as well as on the community it is part of. It also leads to the establishment of new partnerships and collaborations with other universities and civil society.

In conclusion, the objective set in our paper has been achieved, and as a future research direction, the authors propose to analyze the importance of the SDGs in achieving the objectives and increasing the quality of education in military higher education in Romania.

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Rolul obiectivului de dezvoltare durabilă patru (SDG4) în integrarea educației pentru dezvoltare durabilă în învățământul superior

Învățământul superior este inițiator al schimbării în societate și de aceea el este în măsură să contribuie la creșterea sustenabilității instituționale și societale. Pentru aceasta este necesar ca întreg învățământul superior, indiferent de domeniul de studii, să integreze în curriculum Educația pentru Dezvoltare Sustenabilă prin intermediul căreia se poate atinge atât Obiectivul de Dezvoltare Durabilă 4, cât și celelalte Obiective de Dezvoltare Durabilă.

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