



Scientific research output on quality education (SDG4): A Bibliometric Study

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Abstract

Education quality (SDG 4) is one of the 17 Sustainable Development Goals adopted by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development. SDG 4 aims to provide inclusive and equitable quality education and advance opportunities for lifelong learning for everyone. The present study uses bibliometric analysis to explore existing scientific research on education quality that directly connects to SDG 4. The 195 scientific research articles published from 2015 to 2022 were investigated for temporal development, scientific collaboration, existing research focus and gaps. Interdisciplinary journals such as Sustainability is found to be dominant sources. Open-access journals make a dominant footprint and the majority of author collaborations are found among authors from countries such as UK, Spain, and USA. In contrast, the research connections among authors from Global South are observed to be weak. However, a significant evolution of scientific research is observed in connection to SDG 4 with increasing studies on higher education and e-learning. This paper significantly contributes to tracking the progress in scientific research related to SDG 4 and highlights the hotspots where more collaboration between scientific communities and policymakers is required.

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Introduction

A quality education system gives all students the knowledge and skills they need to achieve in life, contribute to their communities, and fully engage in a global society. It aims to foster critical thinking, creativity, problem-solving, and communication skills in addition to knowledge gain.

Quality education is also inclusive and egalitarian, ensuring all students have equal access to education regardless of socioeconomic status, gender, race, ethnicity, or any other type of prejudice. This indicates that educational systems should be developed to accommodate all types of learners, including those with unique needs such as impairments.

Global sustainable development is a common target of human society. The Sustainable Development Goals (SDGs), endorsed by the head of state of the UN member states during the UN General Assembly's 70th session in September 2015, lay out a plan for global transformation. These SDGs, also known as global goals, continue the millennium development goals (MDGs) policy of eradicating all types of poverty and emphasizing inequality and climate change even more. The 193 United Nations Member States, numerous experts, and representatives of organizations from various civil society sectors participated in a deliberative process to ensure greater participation of all nations in these activities.

'Quality Education,' one of the 17 development goals (SDG Goal 4), has been defined as 'provide inclusive and equitable quality education and encourage lifelong learning opportunities for all'.

The 2030 Agenda, however, also prioritizes education as a key component of achieving many other sustainable development goals, such as Goals 3 (Health and Well-Being), 5 (Gender Equality), 8 (Decent Work and Economic Growth), 12 (Responsible Consumption and Production), and 13 (Mitigation of Climate Change). The vision of education with these many aims is likely influenced by the fundamental principles of many adult and lifelong education and learning practices. For instance, the UNESCO guidelines on how to modularize education within the 2030 agenda identify three underlying principles as follows: first, 'Education is a fundamental human right and an enabling right;' second, 'Education is a public good;' and third, 'Gender equality is inextricably linked to the right to education for all.'

SDG4 (Sustainable Development Goal 4) aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. A bibliometric study on quality education would involve analyzing and mapping the research landscape, including trends, patterns, and gaps in the existing literature on this topic.

Such a study would involve collecting and analyzing data on publications related to quality education, including journal articles, conference papers, and book chapters. The study would aim to identify the key authors, institutions, countries, and research topics that have contributed to the research in this area.

Additionally, the study could analyze the trends and patterns in the research, such as changes in the focus of research over time, the emergence of new research areas, and the relative importance of different research topics. The study could also identify gaps in the literature, such as under-researched areas or issues that require further investigation.

Overall, a bibliometric study on quality education would provide valuable insights into the state of research in this area, which could inform policy and practice related to improving access to quality education for all.

Objectives of the Study

- RQ 1. Which year was the most output research in SDG-4?
- RQ 2. What are the most productive countries in SDG-4 research?
- RQ 3. What are the most relevant keywords used in SDG-4 research?
- RQ 4. What are the main research areas in SDG-4 research?

Literature Review

According to the United Nations, one of the Sustainable Development Goals (SDGs) is to ensure inclusive and quality education for all (SDG4). Quality education has been recognized as necessary for reducing poverty, promoting gender equality, and improving health outcomes. In recent years, there has been a growing interest in research on quality education, and bibliometric studies can help us understand the trends, patterns, and gaps in this field.

Bibliometric is a field of study that focuses on analysing research activities (such as production, evolution, collaboration, effect, etc.) in order to comprehend the dynamics of science across disciplines, institutions, and nations. According to a keyword search, there are numerous

scientometric studies that have previously examined sustainability, sustainable development, or sustainability science (Pulgarín *et al.*, 2015; Ramírez Ríos *et al.*, 2016; Wu *et al.*, 2019)^[7, 8, 12]. In few studies (Bizerril *et al.*, 2018; Veiga Ávila *et al.*, 2018)^[3, 10], the output of sustainability in higher education was analysed. Yet, due to the inherent difficulties in evaluating the contributions of research to the SDGs, only a few studies have particularly assessed scientific output on those goals (Armitage *et al.*, 2020)^[2]. Despite these difficulties, some studies related to bibliometrics have tried to analyze higher education system in creating an open approach for SDG-4 quality education (Khan *et al.*, 2022)^[5]. Alonso-García *et al.*, (2019)^[1] analyzed trends and challenges for sustainability for good teaching practices with ICT in Spanish higher education.

Overall, these studies suggest a growing interest in research on quality education, focusing on topics such as teacher training, educational policy, and technology in education. However, there still needs to be more research on marginalized groups and the implementation of SDG4 in different contexts, indicating a need for further research in these areas.

Additional research is required to understand the need for more literature on SDG 4. To do this, Scopus Database analysed articles published during 2015–2022 on the respective topics. The bibliometric methodology includes static and dynamic analyses of publications by years and in geographical terms for a selected research area. The thematic focuses, keywords and their clustering are explored, and a study of the research contributions to SDG 4 and its investment by countries, affiliates, and sectors is conducted.

Methodology

A bibliometric study is a quantitative research method that uses statistical analysis to examine patterns in published literature. A bibliometric analysis is used to evaluate a field of study and its progress in a systematic manner using a rigorous quantitative approach. In terms of the top authors, journals, nations, and organizations in a specific field of study, the bibliometric analysis also helps identify significant and influential academic literature. The bibliographic data were extracted from Scopus's online database. In addition to offering a sizable collection of scientific publications in science, technology, medicine, social sciences, arts, and humanities, Scopus also provides many operational features that allow bibliometric analysis. The defined time frame was the period from 2015 to 2022. To conduct a bibliometric study of quality education, it is important to identify keywords that are relevant to the topic. We conducted our search using the following key search string:

TITLE-ABS-KEY= (Quality Education AND Sustainable Development AND GOAL 4) AND PUBYEAR= 2015 to 2022 AND (LIMIT-TO (LANGUAGE, "English"))

Once the relevant articles have been identified, analyze the data to identify trends, patterns, and gaps in the literature. This could involve using citation analysis to identify the most cited articles, co-citation analysis to identify the most influential authors, and content analysis to identify the key themes and topics discussed in the literature.

A total of 203 studies were obtained between 2015 and 2022. Using this search string helped to sort and collect the scientific publications that explicitly mentioned SDG 4 in their text. This assists in locating the scientific fields with relevant connections to SDG 4. Boolean operators were employed in the current study to select the final dataset and omit pointless research articles. All documents of the type (Research Articles, Conference Papers, Book Chapters, Notes, and Reviews) published in English were included in the extracted data. At the end of the process, 193 articles remained in the database for bibliometric analysis.

Bibliometric analysis has been made possible by developing research tools like Bibexcel, Histcite, CiteSpace, and Gephi. The R programming language and the VOSviewer programme are used in this essay. The co-occurrence network visualization tool offered by VOS viewer software makes it easy to trace the knowledge organization of a scientific topic. Finally, interpret the results of the bibliometric study to conclude the state of the literature on quality education (SDG4). This could include identifying key research gaps and areas for future research. Overall, a bibliometric study of quality education (SDG4) can provide valuable insights into the state of the literature on this topic and help guide future research and policy decisions.

Results

The bibliographic data used for data analysis from 2015 to 2022 indexed in Scopus, the SDGs adopted in 2015. By the following eight years, no publication was found between 2015 and 2016. The analysis of the period from 2017 to 2022 reveals an overall quantity of published papers equal to 73 (Figure 1). Recent years have seen a rapid growth of research connecting SDG 4 and its targets with 73 articles published in 2022. By the start of 2017, only four articles were published; this year was the lowest number of articles published. In this sense, research work towards attaining SDG 4 targets is rapidly growing, which increases the visibility of the research work and its translation into SDG 4-related actions in future.

Documents by Study Type

In the analysis of the type of document during 2017 to 2022 on quality education indexed in Scopus database. Figure 2 shows there were five documents type on quality education found during the study period. The most frequent types of publications obtained in the results belonged to the “article” category (n- 133) and the 2nd place was represented by “conference papers” (n- 22), followed by “book chapters” (n- 17), “reviews” (n-12), and “note” (n- 11).

Country Scientific Output

The country assessment considered the country of affiliation of the researchers worldwide as shown in Figure 3. Most of the documents retrieved originated in the United Kingdom (n-35), with an increasing tendency since 2017. In second place comes Spain with 21 publications, followed by the USA with 20 and Australia and India with the same contribution, i.e. 19 articles.

Sources of Publications

A total of 195 articles were published in 105 journals, ranging from 2015 to 2022. Table 1 lists the top ten journals, which together account for 71 of the articles in our data set. Sustainability has the most publications which were 37 articles, followed by the International Review of Education with 8, and the World Sustainability Series with six articles. The top 10 journals mostly involve education or social issues, with some having high citations, including Sustainability (444) and Journal of Cleaner Production (229). This analysis revealed a significant rise in SJR scores for SDG-4, from 0.24 to 2.48. The highest trend for journals Journal of Sustainable Tourism was 2.48.

Keyword Analysis

In VOS Viewer maps, keywords (or nodes) are placed so that their proximity relates to how often they occur together. It can be argued that terms that are close together on the map are connected thematically since they frequently appear together in the titles and abstracts of the papers.

A minimum number of occurrences of a keyword of three were applied. Of 667 keywords, 43 meet this minimum threshold. For each of the 43 keywords, the total strength of the co-occurrence links with other keywords was calculated (see Figure 4). The keywords with the highest total link strength (471) and links (193) were selected. The following four clusters were identified: cluster 1, with terms related to “higher education;” cluster 2, with terms about “quality education (sdgs 4);” cluster 3, with terms on “sustainable development goal 4;” and cluster 4, with terms including terms related to the “sustainable development goals” and “education for sustainable development.” More general terms such as “sustainable development goals” with 40 occurrences, “sustainable development goals (sdgs)” with 29, and “higher education” with 21, respectively.

Research Area

In the analysis of the research areas during the studied eight-year period in quality education research. The research areas of the published articles as shown in Figure 5. Documents may have more than one research area. The most common areas for quality education documents were Social Sciences with 133, followed by Environmental Science with 73, Energy with 46 Engineering with 28, and Computer Science with 25.

Discussions and Conclusion

Quality Education (SDG4) is one of the 17 Sustainable Development Goals (SDGs) adopted by the United Nations in 2015, aimed at providing inclusive and equitable quality education and promoting lifelong learning opportunities for all. In recent years, there has been growing interest and research in quality education and its importance in achieving sustainable development. The major goal of SDG 4 is to ensure that all people have access to inclusive, egalitarian, and high-quality education. By 2030, all boys and girls should have access to free, impartial, high-quality primary

and secondary education that produces useful and efficient learning results. SDG 4 must be implemented to address various concerns, such as expanding educational opportunities for all people and enhancing access to high-quality education.

A bibliometric study is a quantitative analysis of published literature, which helps identify the key themes, trends, and patterns in a particular research area. In the case of SDG4, a bibliometric study can provide valuable insights into the importance of quality education and its impact on sustainable development.

According to the results and scope of this bibliometric analysis, the scientific community should be aware that education is a cornerstone for sustainable human development. This paper aims to summarize the number of documents, citations, and geographic distribution of the quality education literature, map the intellectual structure and highlight emerging keywords in the research domain using the bibliometric method. We use the R programming and VOS viewer software tools to analyze 2,459 articles published between 2015 and 2022. Scientific journals perform critical responsibilities in the scientific community. The most significant effect measurements of scientific literature are bibliometric and citation indicators, which are used to evaluate scientific performance.

To the best of our knowledge, this is the first bibliometric analysis that relates existing scientific research on quality education. The increment of literature on this subject is evident in SDG-4 over time. It is more noticeable around 2015, the year of the adoption of SDGs. This trend suggests that countries invest in quality education policies to reach the established SDGs. This paper significantly researchers to tracking the progress in scientific research related to SDG 4 and highlights the hotspots where more collaboration between scientific communities and policymakers is required. Some of the key findings of bibliometric studies on SDG4 include the following:

- Quality education is a widely researched topic, with many publications in the field.
- There is a growing trend towards interdisciplinary research on quality education, including education, psychology, sociology, economics, and public policy.
- The importance of quality education is widely acknowledged, with research highlighting its role in promoting economic growth, reducing poverty, and improving health outcomes.
- There is a growing emphasis on the need for quality education to be inclusive and equitable, focusing on addressing the needs of marginalized and disadvantaged groups.

- There is a need for more research to be conducted on the effectiveness of different educational interventions and strategies and their impact on sustainable development.
- Overall, the findings of bibliometric studies highlight the importance of quality education in achieving sustainable development and the need for continued research and innovation in this field.

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