

## A Bibliometric Analysis on SDG 4: Quality Education

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**Abstract.** *Sustainable Development Goal 4 (SDG 4) ensures inclusive, equitable, and quality education for all while promoting lifelong learning opportunities. Quality education is essential in addressing global challenges, breaking the cycle of poverty, improving health, and fostering economic growth. It encompasses well-trained educators, relevant curricula, safe learning environments, and access to educational opportunities for marginalised communities.*

*This document explores the significance of SDG 4, emphasizing its role in eliminating gender disparities, supporting people with disabilities, and ensuring education remains accessible and effective. Additionally, bibliographic analyses, citation networks, and collaboration trends in research related to SDG 4 are examined through VOSviewer visualizations. These analyses reveal key thematic clusters, influential authors, and research collaboration patterns within the field. By improving education quality and accessibility, SDG 4 contributes to the achievement of broader global goals, including gender equality, economic sustainability, and improved societal well-being.*

**Keywords:** *Education, Sustainable Goal, Trained Educators, Learning Environment.*

## 1. Introduction:

The 4th Sustainable Development Goal (SDG) is "Quality Education," which aims to ensure inclusive, equitable, and quality education for all and promote lifelong learning opportunities. Education is fundamental to addressing many global challenges and plays a crucial role in breaking the cycle of poverty, improving health, promoting gender equality, and fostering economic growth. Quality Education refers to an educational experience that is inclusive, equitable, and provides opportunities for all learners to acquire the knowledge, skills, and competencies necessary for personal and societal development. It goes beyond simply accessing education, aiming to ensure that education is meaningful, effective, and relevant to individuals and communities. Quality

education includes well-trained teachers, appropriate learning materials, safe and supportive learning environments, and a curriculum that addresses both academic and life skills, such as critical thinking, problem-solving, and adaptability.

It is not just about formal schooling but also emphasizes lifelong learning, skills development, and opportunities for continuous growth. Achieving quality education helps individuals break the cycle of poverty, improves overall well-being, and contributes to sustainable economic and social development. Quality education is a fundamental human right and plays a key role in advancing other global goals, including gender equality, health, and poverty alleviation.

Specifically, SDG 4 seeks to provide free, quality primary and secondary education to all children, ensure access to affordable vocational training, and promote higher education opportunities. It also emphasizes the importance of promoting skills for employment and lifelong learning to help individuals adapt to rapidly changing technological and economic landscapes. The goal also focuses on eliminating gender disparities in education, ensuring accessibility for people with disabilities, and improving educational facilities in marginalized communities, including rural areas and those affected by conflicts. Through these efforts, SDG 4 aims to build a more educated, empowered, and equitable global society, helping individuals and societies unlock their full potential.

## **2. Literature Review:**

Meeting stakeholder expectations, raising educational standards, and guaranteeing institutional responsibility all depend on quality assurance in higher education. VOSviewer was used to analyze the data in order to find trends and developments in the field. These results give a solid basis for furthering academic research and real-world quality assurance applications, and they offer insightful information to direct future studies in tackling new issues in higher education. Improving learning quality through education management optimization is known as quality assurance in higher education. Trends and perspectives from a systematic literature analysis Suwito Eko Pramono (+1), November 30, 2024.

This study uses the literature review technique to investigate how improving educational management can raise learning quality. Finding and choosing pertinent material is the first step in the research process. Next, these sources are critically analyzed to assess their caliber and applicability. Enhancing learning quality through education management optimization (Endrik Sugianto) July 9, 2024.

The effect of educational quality on economic growth is covered in the article. The state's primary asset is its human capital, and the degree of development of these resources determines the nation's economic expansion. VOSviewer handles the approach for the study of educational quality. Comparative evaluation of the advancement of high-quality education and culture under the circumstances of the quality education. Economic development potential of high-quality education (A. Zhumagulova, +1) June 30, 2024.

Many students now exclusively focus on their academic performance in light of the economy's rapid development. The overall quality continuously decreases as their academic performance improves. For kids, receiving a high-quality education is becoming increasingly crucial. Quality education does not have a single, universally accepted definition or model, nor is there a single, set

approach. The process of giving pupils at educational institutions a high-quality education (Svetlana G. Nikolaeva, +2) January 1, 2024.

### 3. Problem Statement

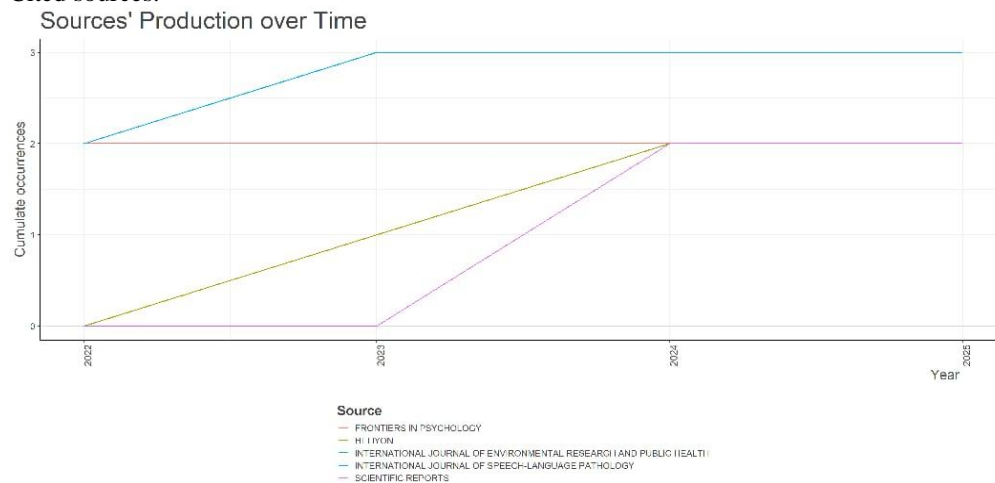
The research problem addressed in this study is the lack of a comprehensive understanding of the global research landscape related to Sustainable Development Goal 4 (SDG 4): Quality Education. Despite the critical importance of inclusive and equitable education for sustainable development, there is limited consolidated analysis of existing academic contributions, key research trends, influential authors, and collaborative networks in this field. This study aims to fill that gap by conducting a bibliometric analysis to map the volume, impact, and structure of research on SDG 4, helping identify current focus areas, emerging themes, and opportunities for future research and policy development.

### 4. Methodology:

This study employs a bibliometric analysis to explore the research landscape surrounding Sustainable Development Goal 4 (SDG 4): Quality Education. Using data extracted from the Dimensions AI database, the study analyzes approximately 15–17 publications published between 2022 and 2025. Bibliometrix, an R-based tool, and VOSviewer are used to clean, process, and visualize bibliographic data. The analysis focuses on key metrics such as publication trends, citation analysis, keyword co-occurrence, and co-authorship networks. VOSviewer further supports network analysis by generating maps of co-authorship, citations, and thematic clusters. This combined methodological approach provides a comprehensive and data-driven understanding of current research efforts, highlighting influential authors, emerging topics, and global collaboration patterns within SDG 4-related studies.

### 5. Results and Discussions:

Cited sources:



**Fig 1.** Show the Sources' Production over Time.

The line graph titled "Sources' Production over Time" illustrates the cumulative occurrences of various sources from 2022 to 2025. The x-axis represents the years, while the y-axis shows the cumulative number of occurrences. Each colored line corresponds to a different source. The "INTERNATIONAL JOURNAL OF ENVIRONMENTAL RESEARCH AND PUBLIC

HEALTH" started with two occurrences in 2022, increased to three in 2023, and remained constant thereafter. "SCIENTIFIC REPORTS" maintained a steady contribution of two occurrences throughout the entire period. "FRONTIERS IN PSYCHOLOGY" showed a gradual increase from zero in 2022 to two in 2024, where it then plateaued. Similarly, "HI LYON" followed a steady growth pattern, increasing from zero in 2022 to two by 2024. In contrast, the "INTERNATIONAL JOURNAL OF SPEECH-LANGUAGE PATHOLOGY" had no contributions before 2024 but saw a sudden increase to two occurrences in that year, remaining constant in 2025. Overall, the graph highlights different publication trends—some sources had an early presence and stabilized over time, while others exhibited a gradual or late rise in contributions. This analysis provides insight into the evolving research output of these journals over the years.

Annual Scientific Production:

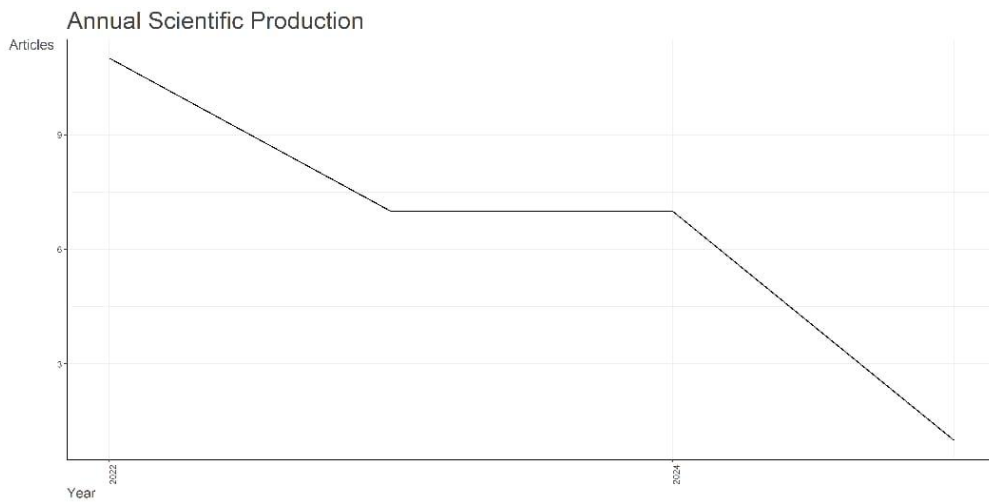


Fig 2. Show the Annual Scientific Production.

The line graph titled "Annual Scientific Production" shows the number of scientific articles produced over three years (2022–2024). The y-axis represents the number of articles, while the x-axis represents the years. The trend indicates a decline in scientific production over time. In 2022, the number of articles was at its highest, exceeding nine. However, there was a significant drop in 2023, where production stabilized at around six articles. In 2024, production declined further, reaching its lowest point, close to zero. This suggests a downward trend in scientific output, which could be due to various factors such as resource constraints, policy changes, or shifts in research focus.

Author’s Local by H Index:

Author	h_index	g_index	m_index	TC	NP	PY_start
ACEVEDO-DUQUE A	1	1	0.333	18	1	2023
AHMED B	1	1	0.500	15	1	2024
BEKELE M	1	1	0.500	15	1	2024
CHAABEN N	1	1	0.250	45	1	2022
CROWE K	1	1	0.250	3	1	2022
DOBRESCU R	1	1	0.250	3	1	2022
DUMITRESCU C	1	1	0.250	3	1	2022
ELLEUCH Z	1	1	0.250	45	1	2022
FERNÁNDEZ-MANTILLA MM	1	1	0.333	18	1	2023
FIA M	1	1	0.250	52	1	2022

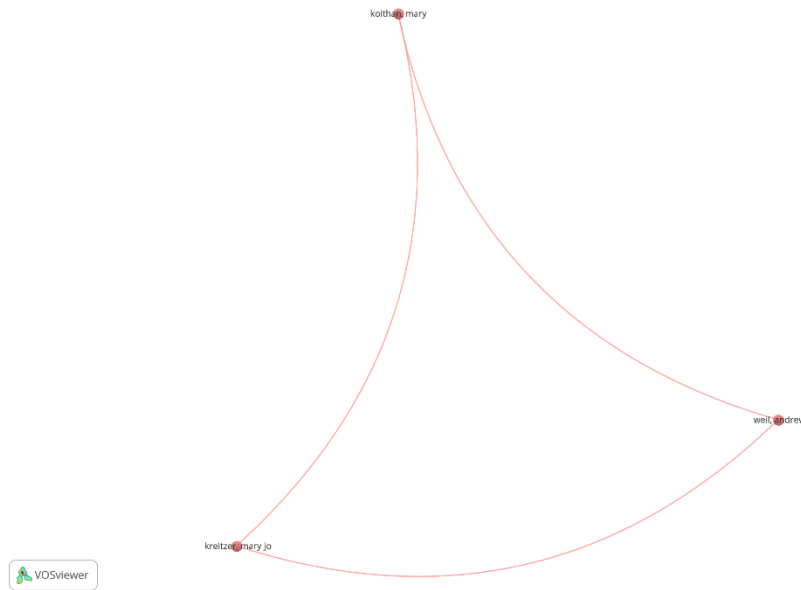


Rwanda. The analysis explores how these areas are interconnected and how they influence each other.

To get a more precise interpretation, you would need to know:

- The dataset used to create the chart: Knowing the source of the data (e.g., specific journals, databases, period) would provide context.
- The specific research question or focus of the analysis: Understanding the purpose of the study would help interpret the relationships between the terms.
- The specific parameters used in VOSviewer: Knowing the settings used to generate the visualization (e.g., co-occurrence thresholds) would provide further insights.

In summary, this network visualization provides a valuable overview of the key themes and relationships within a body of research related to health, education, and sustainable development. By analysing the clusters and connections, you can gain a deeper understanding of the complex interplay between these areas.



**Fig 4.** Bibliography analysis co- authorship and citation

- Co-authorship: These individuals may have co-authored publications together.
- Collaboration: They might have collaborated on research projects or other academic endeavours.
- Citation Network: One author might have cited the work of the others, or their work might be cited together by other researchers.

In essence, the chart shows a simple network of three individuals who are somehow related to each other, most likely through shared academic work. Without further context, it's difficult to determine

the exact nature of their relationship. However, the visualization effectively illustrates their connection.

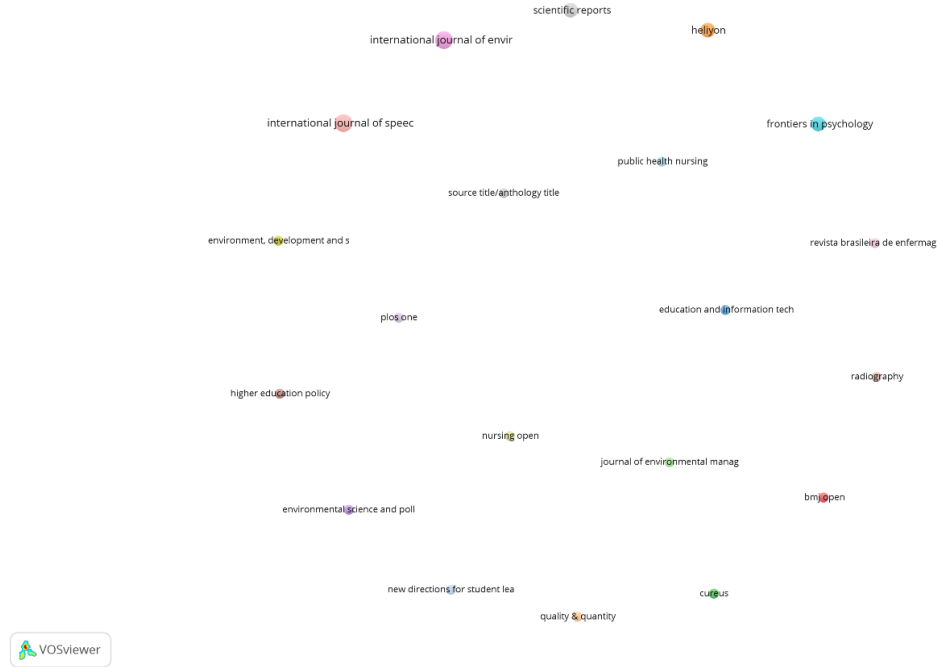


**Fig 5.** Bibliography analysis of countries

This is a network visualization created using VOSviewer, showing the relationships between four items: "United States," "Australia," "key," and "Pakatan."

**Interpretation:**

1. Nodes: Each word represents a node in the network.
2. Edges: The lines connecting the nodes indicate that these items are related in some way. The presence of lines between "Australia," "key," and "Pakatan" suggests they are more closely interconnected than "United States."
3. Clustering: The nodes are somewhat spatially separated but don't form distinct clusters. This suggests a relatively loose connection between all four items.
4. Colour Coding: The nodes are coloured differently. While the meaning of the colours is not explicitly provided, it often indicates clusters or groups identified by the software during analysis. In this case, "United States" is yellow, "Australia" is red, "key" is blue, and "Pakatan" is green.



**Fig 6.** Bibliography analysis co- citation and co-occurrence.

**Nodes:** Each label represents a source title (journal, book, conference proceedings, etc.).

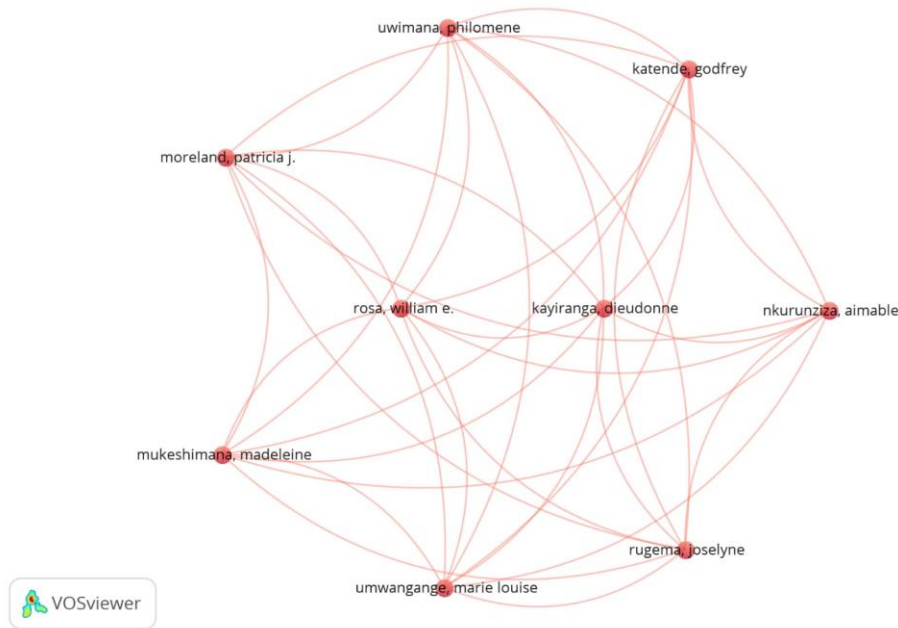
**Edges:** The lines connecting the nodes (though faint in this image) indicate relationships between the sources. These relationships are likely based on:

- **Co-citation:** Two sources are cited together in other publications.
- **Bibliographic Coupling:** Two sources cite the same publications.
- **Co-occurrence of terms:** The journals might share common keywords or subject areas.

**Clustering:** The nodes are somewhat spatially distributed, forming a loose, circular pattern. There's not a strong indication of distinct clusters, suggesting the journals might cover related but diverse topics.

**Colour Coding:** The nodes are coloured differently. The meaning of the colours is not explicitly provided, but it often indicates clusters or groups identified by the software during analysis. In this case, the colours are quite varied, further suggesting a lack of strong clustering.

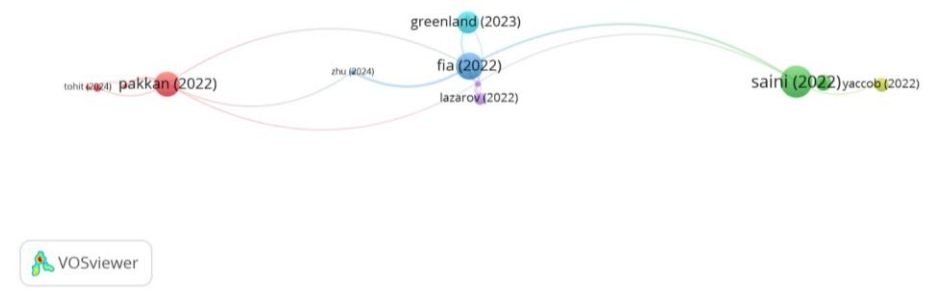
**Size:** The size of the nodes appears relatively uniform, suggesting that the sources have a similar level of importance or frequency of citation within the dataset.



**Fig 7.** Bibliography analysis author and co-authors

This VOSviewer network visualization represents co-authorship relationships among researchers. Nodes (circles) indicate authors, with larger nodes showing more influential contributors. Lines (edges) represent collaboration strength—thicker lines imply stronger co-authorship. The diagram highlights a strongly interconnected research network, with key authors like *Uwimana Philomene*, *Moreland Patricia J.*, and *Nkurunziza Aimable* having multiple connections. This can be used for analyzing collaboration patterns, identifying influential researchers, and exploring future research partnerships.

The presence of dense connections suggests that these researchers frequently collaborate, potentially within a specific field of study. Authors with fewer connections, such as *Katende Godfrey* and *Mukeshimana Madeleine*, may have specialized roles or limited collaborations within this network. This analysis can be valuable for understanding research collaboration patterns, identifying influential authors, and finding potential research partners to strengthen academic or professional networks.



**Fig 8.** Bibliography analysis author and citation

### Central Nodes (Highly Connected Authors/Papers)

- *Fia (2022)* appears to be a central node, strongly connected to multiple papers such as *Greenland (2023)*, *Lazarov (2022)*, and *Pakkan (2022)*.
- This suggests *Fia (2022)* is a highly influential paper or researcher, widely cited and collaborating with others.

### Clusters and Colour Representation

- Different colours represent distinct research clusters or thematic areas.
- The red cluster (left side) includes *Pakkan (2022)* and *Tohit (2024)*, indicating they are closely related or frequently cited together.
- The blue cluster (center) revolves around *Fia (2022)* and *Greenland (2023)*, showing another area of strong interconnection.
- The green cluster (right side) consists of *Saini (2022)* and *Yaccob (2022)*, suggesting another thematic link.

### Peripheral Nodes (Less Connected Authors/Papers)

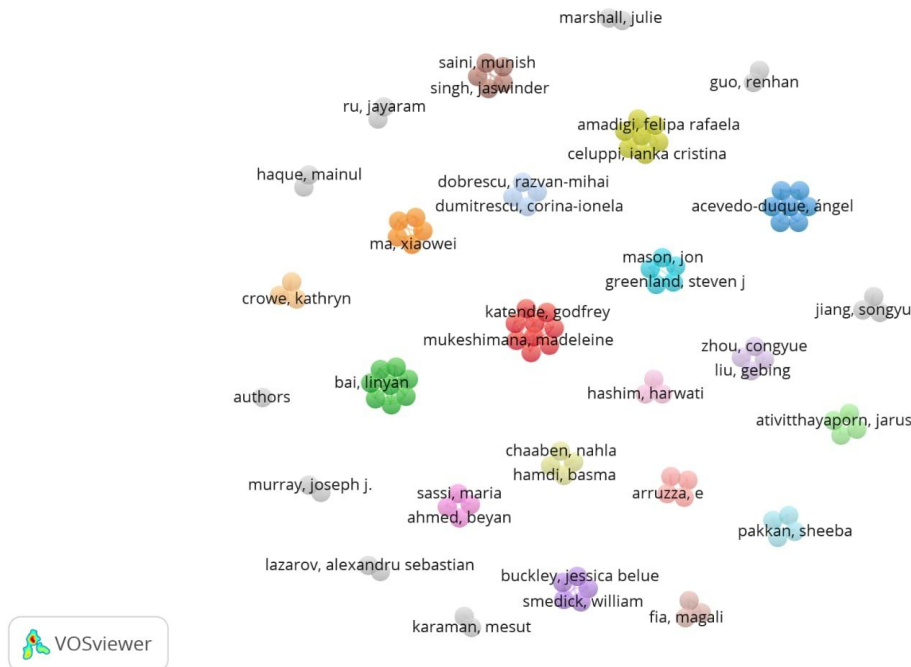


Fig 9. Bibliography analysis Cluster analysis of Authors

## Clustered Research Communities

- The network is divided into multiple clusters, each representing groups of authors collaborating closely on similar research topics.
- For example, the red cluster (Katende, Godfrey & Mukeshimana, Madeleine) and blue cluster (Acevedo-Duque, Angel & Greenland, Steven J) indicate strong collaborations.

## Central and Peripheral Authors

- Central nodes (larger, denser clusters) indicate influential authors or well-connected research groups.
- Peripheral authors (smaller, isolated nodes) indicate researchers with fewer collaborations or independent contributions.

## Collaboration Patterns

- Some authors, like Marshall, Julie & Bai, Libyan, seem less connected, implying either niche research focus or fewer co-authorships.
- Authors like Fia, Magali & Pakkan, and Sheba are clustered, suggesting a specific research collaboration.

## Conclusion:

Sustainable Development Goal 4 (SDG 4) aims to provide inclusive, equitable, and quality education for all, emphasizing lifelong learning opportunities. Achieving quality education is essential for breaking the cycle of poverty, improving health, fostering economic growth, and promoting gender equality. The document highlights key aspects of SDG 4, including access to free primary and secondary education, affordable vocational training, and higher education opportunities. Additionally, it stresses the importance of eliminating gender disparities, supporting individuals with disabilities, and improving educational infrastructure in marginalized and conflict-affected areas. Through bibliographic analysis and network visualizations, the study underscores the interconnectedness of education, health, and sustainable development. Collaboration patterns among researchers, citation networks, and key thematic clusters provide insight into academic contributions toward SDG 4. In conclusion, investing in quality education is a fundamental step toward building an educated, empowered, and sustainable society. Strengthening educational policies, enhancing research collaborations, and ensuring accessibility for all learners will accelerate progress toward achieving this global goal.

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