Bridging Education Gap through Educational Innovation for Sustainable Development: A Bibliometric Analysis of the Scopus Database

95

IJOLAE

Bridging Education Gap through Educational Innovation for Sustainable Development: A Bibliometric Analysis of the Scopus Database

Novita Sari Dwi Fatmawati[1], Wida Wulandari[2✉], Nico Irawan[3]

[1-2]Faculty of Economics dan Business, Universitas Negeri Surabaya, Indonesia
[3]Thai Global Business Administration Technological College, Thailand

Abstract

This study examines the global research landscape on educational inequality and its contribution to achieving Sustainable Development Goal 4 (Quality Education) through a comprehensive bibliometric analysis. Using data retrieved from the Scopus database, 190 peer-reviewed journal articles and conference proceedings published between 2015 and 2025 were systematically analyzed. The bibliometric procedures included publication trend analysis, citation analysis, co-authorship networks, keyword co-occurrence, and thematic mapping using VOSviewer and Bibliometric software. The results indicate that research on the education gap has shown a stable but intensifying trend, with a significant increase in publications during and after the COVID-19 pandemic, reflecting growing global concern over widening educational disparities. The findings reveal that the education gap is primarily driven by socioeconomic status, digital inequality, family background, regional disparities, and teacher quality. Highly cited studies emphasize that inequalities in learning opportunities emerge from early childhood and are reinforced by unequal access to technology, quality schooling, and supportive learning environments. The analysis also identifies the United States, China, and the United Kingdom as the most influential contributors to this field, with strong international research collaboration patterns. Thematic and conceptual structure analyses demonstrate that educational inequality is closely linked to sustainable development, digital transformation, academic performance, and social inclusion. Importantly, this study highlights the growing relevance of policy-oriented solutions, including student loan systems, digital infrastructure development, and targeted social interventions, as strategic mechanisms to reduce educational inequality and expand access to higher education. Overall, this bibliometric mapping provides a comprehensive overview of the evolution, structure, and key drivers of research on the education gap. The findings offer valuable insights for policymakers, educators, and researchers in designing evidence-based strategies to promote equitable, inclusive, and sustainable education systems in support of SDG 4.

Keywords: educational equity, educational disparities, education gap, sustainable education, global education policy

✉*Corresponding Author:*
Wida Wulandari, Department of Economics Education, Universitas Negeri Surabaya, Surabaya, Indonesia
Email: widawulandari@unesa.ac.id

1. Introduction

Education is one of the key factors in improving individual welfare and the progress of a nation (Wulandari et al., 2025). However, the reality is that access to and the quality of education are still far from equal. The education gap is a global problem that affects social and economic development. Broer et al. (2019) stated that socioeconomic factors are the main determinants of differences in academic achievement, with students from lower-income families often experiencing limited access to quality educational resources.

In today's digital age, access to educational technology should help reduce educational inequality. However, in practice, digitization has actually widened the gap between communities with stable internet access and those without (Jafar et al., 2023). Globally, educational inequality remains a serious problem, especially in developing countries. According to a UNESCO report (2022), approximately 244 million children and adolescents worldwide still lack access to formal education, with higher dropout rates in Sub-Saharan Africa and South Asia. Inequalities in the distribution of educational resources, limited infrastructure, and social and political conflicts further widen this gap (UNESCO, 2022).

In their study, Liao et al. (2022) showed that educational mobility, particularly education-based migration, has a significant impact on economic development, with apparent positive effects on productivity growth in the country of origin. In addition, the COVID-19 pandemic has exacerbated this situation. A study by Bozkurt et al. (2022) shows that the shift to online learning has widened the educational gap, especially for groups without adequate access to technology and the internet, including in developed countries such as the United States and the United Kingdom.

The education gap in ASEAN countries, including Indonesia, remains a significant challenge. Although access to education in Indonesia has improved, the differences between urban and rural areas remain stark. Research shows that children in rural areas often face limitations in accessing adequate educational facilities, which affects their low learning outcomes, underscoring the need for educational development to meet the needs of the "digital native" generation (Malik, 2018). Students from more affluent families have better access to technology and online learning resources, while those from less affluent families face difficulties in keeping up with developments in digital education (Widiasanti et al., 2023). Based on data from the Central Statistics Agency (Badan Pusat Statistik (BPS), 2022, there are significant differences in the quality of education between urban and rural areas. Students from low-income families have less access to quality education than those from more affluent families. This inequality shows that, in addition to access to technology, economic factors also play a significant role in widening the education gap in Indonesia (Central Statistics Agency (BPS), 2022).

Educational disparities also occur in various countries, such as China, as revealed by Wang et al. (2017) and Zhang (2023), who found educational disparities between migrant children attending private schools and those in cities. In line with Phan et al. (2020), they found a significant educational gap across all levels of education in Vietnam. Upreti & Malhotra (2024) highlighted the educational and infrastructure disparities between urban and rural areas, which require the use of Corporate Social Responsibility (CSR) as a strategic step to reduce educational gaps. Meanwhile, in Indonesia, Fitri (2021) highlights that the low quality of education is partly influenced by frequent curriculum changes, limited teacher competence, infrastructure limitations, and the digital divide in rural areas. Prosperous and equitable education not only expands the community's skills but is also an important factor in creating equitable social welfare. Based on this research, equal access to education for all levels of society is crucial to support sustainable human development.

The world views education as an important sector with a long-term, sustainable impact. Education is an integral part of the 2030 Sustainable Development Goals

Bridging Education Gap through Educational Innovation for Sustainable Development: A Bibliometric
Analysis of the Scopus Database

97

(SDGs), specifically Goal 4: Quality Education. The aim is to analyse the gaps and quality of education that contribute to sustainable development efforts (SDGs). In this case, it is important to assess the extent to which policy responses have been implemented to achieve SDG 4: Quality Education. The quality of education is not merely a subjective concept but a measure of conformity with the goals set by educational institutions (Rahmiaty et al., 2025). In this context, implementing a standardized system is a strategic approach to ensuring quality by integrating various methods of performance evaluation, quality assurance, and continuous improvement (Rahmiaty et al., 2025). The main challenge in implementing education policy stems from the complexity of local politics, as seen in Indonesia (Rasaili et al., 2021). Describe how local political dynamics significantly influence education policy and the implementation of SDG 4. This statement is supported by the findings of Asadullah et al. (2020), which show that, despite progress towards achieving SDG 4 on Quality Education, gaps in educational outcomes by socio-economic status persist and require responsive policies. Collaborative efforts across various sectors are crucial to realising SDG 4, and higher education institutions can play a transformative role (Wei & Chen, 2024; Wulandari et al., 2025). Achieving SDG 4 requires cross-sectoral collaboration that considers the local political context, technology, and strong collaboration between various stakeholders.

This study focuses on mapping articles on educational inequality and its contribution to achieving SDG 4, as well as analysing factors that influence the quality of education. The benefit of this study is to identify all aspects of educational inequality requiring further research to achieve the Sustainable Development Goals (SDGs). Based on the phenomena that occur and the identification of research gaps, the research questions and objectives of this study are as Analysing factors that influence educational disparities and quality that contribute to sustainable development efforts (SDGs).

This study is expected to provide a comprehensive overview of the direction of research on educational inequality and strengthen efforts to achieve sustainable development in education over the past decade. Bibliometric analysis is a relevant method. Through bibliometric analysis, this study provides a comprehensive mapping of the development of research on educational inequality, covering current publication trends, influential authors, major reference journals, average citations per year, and the distribution of authors by country. In addition, this mapping helps identify research gaps that have not been widely studied, providing a basis for future research.

2. Method

The first step in conducting a bibliometric literature analysis is to determine the scope of the research study. This is important because it relates to the content and amount of data to be analysed (Waltman & van Eck, 2012). The keywords used to analyse the "Education Gap" were taken from the Scopus database. The data were collected without specifying publication type, year of publication, or field of study. There were 529 document types. After that, a filtering process was carried out to limit the study to 10 years (2015-2025), yielding 371 documents. For the field of study, the researchers focused on social sciences, economics, econometrics, business finance, management, and accounting, resulting in 217 databases. For the document type (journals and conference proceedings), 196 databases were identified. The language

selection was English, resulting in 190 documents. The 190 documents were then converted into BibTex and RIS (Research Information System) formats. The data were then imported into software using VosViewer and Bibliometric (version 2024.12.1+563) to calculate citation counts, examine publication trends, and identify developments in the concept of the Education Gap. VOSviewer was applied not only for data visualisation but also to determine several types of analysis, such as the relationship between co-authorship and organisation, the relationship between co-occurrence and authors, the relationship between citations and author countries, and so on (Hassan et al., 2022).

The use of the Scopus database in this study was chosen because Scopus is one of the highly reputable international databases that provides broad access to quality scientific articles from various countries and scientific fields. Scopus's comprehensive coverage allows researchers to explore global trends, identify the most influential authors, and find publications with a significant impact on educational inequality. In addition, this study uses only English-language articles, as English is the primary academic language globally, facilitating cross-country comparisons. Bibliometric analysis is used to identify new trends in article and journal performance, collaboration patterns, and research components, and to explore the intellectual structure of a particular field in the existing literature (Donthu et al., 2021). Researchers use bibliometric analysis because it provides an objective picture of research developments in a particular field by analysing publication metadata, article counts, author collaboration patterns, and keyword trends. Thus, this method is relevant for identifying the extent to which educational inequality has been researched, the direction of topic development, and research gaps for further study. The urgency of applying bibliometrics lies in its ability to systematically and objectively reveal research gaps, thereby providing clearer direction. The process and method of article selection in this study are described in detail in Figure 1: Process and Method of Article Selection, which illustrates the stages of identification to systematic data inclusion.
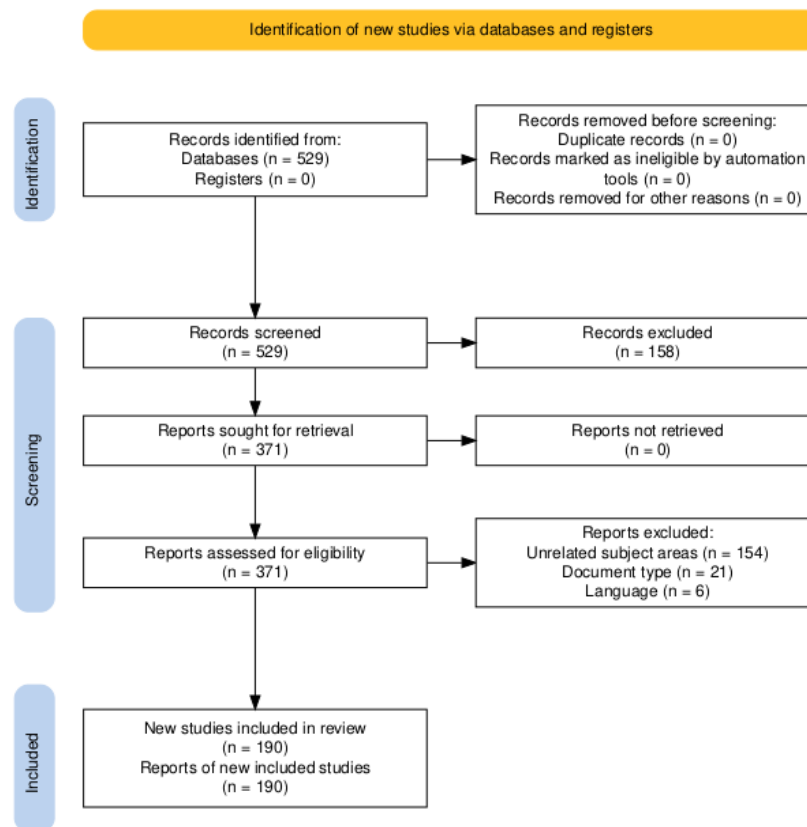
Bridging Education Gap through Educational Innovation for Sustainable Development: A Bibliometric Analysis of the Scopus Database

99

Figure 1. Process and Method of Article Selection

The initial stage of the bibliometric analysis involved determining the study's scope by searching the Scopus database for the keyword "Education Gap." The initial search yielded 529 documents, which were filtered to publications between 2015 and 2025, leaving 371. Next, in the eligibility stage, the research focused on the social sciences, economics, econometrics, business finance, management, and accounting, reducing the total to 217 documents. Only publications in the form of English-language journals and conference proceedings were included in the included stage, resulting in 190 final articles being analysed. This process reflects the systematic selection stages outlined in the PRISMA flow, ensuring coverage of relevant and credible data.

The filtered documents were extracted using Microsoft Excel (.csv) files containing affiliations, author names, titles, countries, journal names, and keywords. The file was then analysed to produce a descriptive summary aligned with the research questions. To visualise the bibliographic data, this study utilised bibliometric software version 2024.12.1+563. This software provides various features for comprehensive bibliometric analysis of scientific publications, including counts of publications, citations, author collaborations, and keywords. In addition, bibliometrics enable standardised calculations and indicators, ensuring analysis results are reliable and consistent with other literature on educational disparities. This study uses quantitative descriptive analysis to obtain key insights into educational disparities, including article titles, journals with the most publications, countries with the most contributions, and affiliations with the highest productivity. This study also explores connections between authors through writing collaboration analysis, applying co-authorship analysis to identify patterns of collaboration in Scopus-indexed publications. In addition, co-occurrence analysis

was conducted to identify relationships between keywords and research topics that frequently co-occur, and citation analysis was conducted to determine the level of influence and the distribution of citations for each publication relevant to educational inequality. This analysis aims to map the development of research trends on educational inequality in support of the Sustainable Development Goals (SDGs).

3. Result and Discussion

To provide an overview of the characteristics of the analyzed data, this section presents a key summary of bibliometric information obtained from Scopus-indexed publications. This information includes publication timeframe, number of documents, journal sources, author collaboration patterns, and citation indicators, which serve as a basis for understanding the development of research on the education gap during the period 2015–2025.

Table 1. Main Information of Bibliometrics

Description	Results
Main Information About Data	
Timespan	2015:2025
Sources (Journals, Books, etc)	165
Documents	190
Annual Growth Rate %	0
Document Average Age	4.11
Average citations per doc	8.616
References	8885
Document Contents	
Keywords Plus (ID)	692
Author's Keywords (DE)	741
Authors	
Authors	550
Authors of single-authored docs	42
Authors Collaboration	
Single-authored docs	43
Co-Authors per Doc	3.01
International co-authorships %	17.89
Document Types	
article	170
conference paper	13
erratum	1
note	2
review	4

Table 1 shows the main information obtained from the Scopus database. This research shows that year-to-year changes have occurred and have had a significant impact. These results are supported by the identification of 165 article sources, involving 550 authors and 190 validated articles, and an average citation count per article on the education gap of 8,616. The annual growth rate is 0%, indicating a stable research trend; however, the average citation count per article suggests the topic remains relevant and contributes to academic research.

a. Publication Trends

Publication trend analysis was conducted to identify the dynamics of research development related to the education gap over time. By mapping the number of annual pub-

Bridging Education Gap through Educational Innovation for Sustainable Development: A Bibliometric Analysis of the Scopus Database

101

lications, this section aims to show growth patterns, fluctuations, and crucial periods reflecting the increasing academic attention to the issue of education gaps in the context of sustainable development.
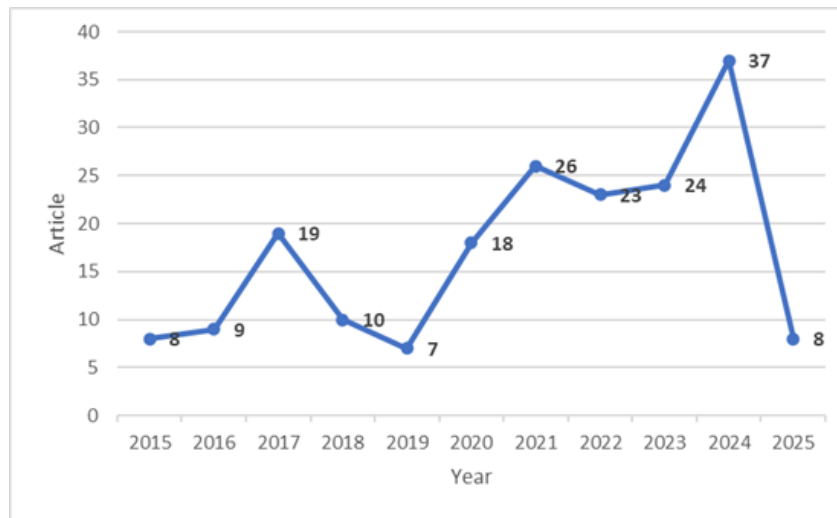

Figure 2. Annual Scientific Production of Education Gap

Based on the Annual Scientific Production graph from Biblioshiny results, the number of articles discussing the topic of Education Gap fluctuates from year to year. These increases and decreases are certainly influenced by several significant factors relevant to the global situation and social developments.

From 2020 to 2023, there was a relatively stable increase, while a significant increase occurred in 2024. This increase was most likely due to the COVID-19 pandemic, which directly affected education systems worldwide. Disparities in access to online learning, technological devices, and teacher-student readiness became the focus of researchers. Many researchers were interested in further examining the educational gaps that became more apparent during the pandemic.

Table 2. View Data Annual Scientific Production of Education Gap

Year	Article
2015	8
2016	9
2017	19
2018	10
2019	7
2020	18
2021	26
2022	23
2023	24
2024	37
2025	8

Table 2 presents data containing the number of publications for each year of publication. Initial publications in 2015 totaled 8 articles, then increased to 9 in 2016 and to 19 in 2017. Then, in the following year, 2018, there was a decrease to 10 articles, and another decrease in 2019 to 7 articles. However, publications increased from 18 in 2020 to 26, 23, and 24 in 2021, 2022, and 2023, respectively. The number of publications continued to surge, reaching a

peak in 2024 with 37 articles, before finally dropping back to 8 articles in 2025.

In line with this, Demetriou (2020) emphasises that an educational gap occurs when students lack adequate preparation to advance to the next level of learning, and the pandemic has exacerbated this condition. The gap is further exacerbated by limited learning support at home, which is generally felt more by economically disadvantaged groups.

The Programme for International Student Assessment (PISA) also shows similar disparities. In their report, Sahyar et al. (2020) stated that only a small percentage of students achieve high levels of scientific literacy, while the majority remain at low levels—particularly students from immigrant and low-income families. This finding indicates a gap between expected competencies and actual learning outcomes, prompting further research to explore the education gap. These findings support the findings of Atiles et al. (2021), who argue that social inequality among children from poor families is due to a lack of parental support. Contrary to Shehaj's (2022) research, inclusive quality education through the application of digital technology can create new opportunities for students to

acquire valuable skills that enhance their future potential.

However, this trend changes by 2025, with the number of publications on this topic declining significantly. This decline is likely due to a shift in researchers' focus to more current and technologically relevant issues, such as the integration of artificial intelligence (AI) and digital transformation in education (Zawacki-Richter et al., 2019).

Furthermore, academic saturation of the education gap topic may also be occurring, given the large number of previous publications that have addressed this issue from various perspectives. As a result, researchers are beginning to identify research gaps.

b. Average Citations

In addition to the quantity of publications, the level of scientific influence of a topic can also be seen from citation patterns. Therefore, an analysis of average citations per year is used to evaluate the extent to which publications on the education gap significantly contribute to the development of knowledge and serve as references in academic studies across time.
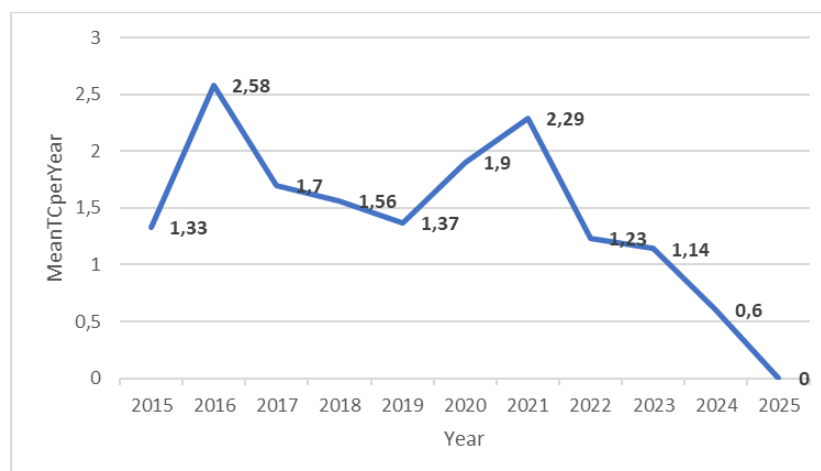

Figure 3. Average Citations per Year

Figure 3 presents a visualisation of Average Citations per Year for scientific articles discussing the theme of Education Gap in the context of Education. This

analysis was conducted using Bibliometric software version 2024.12.1+563, which utilises data from the Scopus database to identify the dynamics of the academic

influence of articles published from 2015 to 2025.

The graph shows that from 2015 to the end of 2021, citations fluctuated widely, peaking around 2016, indicating that published articles were widely read and frequently referenced by other researchers.

However, after 2022, the citation trend declined sharply until 2025. Two factors contribute to this: first, newer articles take longer to be cited (citation lag), and second, research focus shifts to other topics or divides into more specific subthemes.

Table 3. View Data Average Citations per Year

Year	MeanTCperYear
2015	1,33
2016	2,58
2017	1,7
2018	1,56
2019	1,37
2020	1,9
2021	2,29
2022	1,23
2023	1,14
2024	0,6
2025	0

Table 3 presents the average citations per year for each publication year. The results in the data view show that publications in 2016 had the highest average citations of 2.58, followed by 2021 with 2.29 citations per year, then 2020 with 1.90, and 2017 with 1.70, indicating that articles during that period received greater scientific attention. Meanwhile, the lower citation values from 2022 to 2025, ranging from 1.23 to 0, were mainly due to the limited citation time frame, so that the accumulation of citations had not yet fully developed.

The documents in this analysis received an average of 8,616 citations per document, reflecting the high relevance and influence of articles examining the Education Gap. These findings reinforce the fact that the Education gap is a significant academic theme and influence, particularly during the COVID-19 pandemic, which has exacerbated educational inequality (Bozkurt et al., 2022).

The sharp decline in citations over the past two years also highlights the importance of observing this trend over the long term. Recent publications cannot be directly compared with older publications in terms of citation counts. Therefore, these results should not be interpreted as a decline in research quality, but rather as a reflection of academic citation patterns.

c. Top Sources

To identify the most influential publication sources, an analysis of top journals or sources was conducted. This section highlights key journals that consistently publish research on education gaps, while also reflecting the dominant disciplinary orientations and theoretical approaches in education gap studies.

Table 4. Top Sources and Their Local Impact

Source Name	N	H_Index	G_Index	M_Index	TC	Py_Start
Journal of Marriage and Family	4	3	4	0.300	152	2016
Economics of Education Review	3	2	3	0.333	48	2020
Education Economics	3	2	3	0.222	12	2017

In a bibliometric analysis of the Education gap, the top three journals with the most prominent contributions were the Journal of Marriage and Family, Economics of Education Review, and Education Economics. All three addressed the issue of education gaps from different perspectives, ranging from childcare and measuring educational quality to ethnic-based inequality.

In the Journal of Marriage and Family, an article titled "The Widening Education Gap in Developmental Child Care Activities in the United States, 1965–2013" discusses the gap in developmental child care time based on parents' education levels in the United States. The identified research gap is the lack of studies that specifically differentiate the quality of child care activities by parents' educational background. The main contribution of the article is the finding that highly educated parents devote more time to cognitive and social child care activities, and that this gap widened during the period 1653-2013. This indicates that educational inequality can occur even before children enter formal schooling. Therefore, it is crucial to design policy interventions from an early age to prevent these disparities from carrying over into subsequent levels of education (Altintas, 2016).

The Economics of Education Review journal, with the article "Learning-Adjusted Years of Schooling (LAYS): Defining a New Macro Measure of Education." This article focuses on developing a new indicator, LAYS, that combines quantity (years of schooling) and quality (learning outcomes). The gap addressed is that conventional education indicators, such as mean years of schooling, typically count only the length of schooling without considering actual learning achievements. This article introduces LAYS as a more equitable measure for assessing human capital across countries. The research findings show that some countries lose up to 60% of the value of their years of schooling when adjusted for learning quality. The implication is that LAYS opens a new perspective for policymakers to focus not only on extending the length of schooling but also on improving the quality of learning (Filmer et al., 2020).

The Journal of Education Economics, with the article "Ethnic gaps in educational attainment and labor-market outcomes: evidence from France," examines educational and labor-market gaps by ethnic background, particularly between second-generation immigrants and native French citizens. The research gap lies in the lack of studies that simultaneously combine education, employment, and wage analysis, as well as the scarcity of ethnic data due to France's egalitarian principle. This article contributes by using rare data (TeO. 2008) and complex econometric methods to unravel the gaps caused by family factors and discrimination. The results show that family background greatly influences educational attainment. The implication is that inclusive education policies alone are not enough to improve access; they must also consider the social and cultural dimensions that influence long-term individual success (Nguyen, 2019).

Overall, the three articles from the Top Sources journal demonstrate that the education gap is not simply a matter of how long someone completes their education, but is closely related to the quality of parenting, the quality of learning, and the socio-cultural context in which the individual is situated.

d. Top Writer

Identifying the most productive authors is a crucial step in bibliometric analysis to understand key actors in scientific development. This section discusses the contribu-

Bridging Education Gap through Educational Innovation for Sustainable Development: A Bibliometric Analysis of the Scopus Database

105

tions of key authors with high productivity and impact in research on educational ine-

quality, as well as the main themes they develop.

Table 5. List of top Authors and their Impact on Education Gap

Authors	Articles	Articles Fractionalized
LESEMAN PPM	3	1,08333333
MA X	3	1,08333333
PIAO X	3	1,08333333

Based on a bibliometric analysis of the Scopus database, the three primary authors are Leseman PPM, Ma X, and Piao X, each having published three articles in this field. These three authors have made significant contributions to understanding the education gap from various perspectives, ranging from public policy to the dynamics of gender roles in the household and the welfare of couples across countries. The article entitled "Universal versus targeted approaches to prevent early education gaps. The Netherlands as case in point" is one of Lesemman PPM's articles, which evaluates the effectiveness of universal and targeted approaches in preventing early childhood education gaps in the Netherlands. The results of the study show that even though Equity policies have been implemented for several decades, educational gaps between socioeconomic groups remain, especially among children from immigrant backgrounds. The findings emphasize that expanding access alone is not enough; policies must also incorporate dimensions of service quality, targeting, and social justice principles to address inequalities early in life (Allen & Cutts, 2018).

The article entitled "The Impact of Intra-household Bargaining Power on Happiness of Married Women: Evidence from Japan" is one of Ma X's studies investigating the relationship between household income and education inequality and wives' happiness. The results show that women with higher income or education than

their spouses actually experience a decline in subjective Well-being. This has implications for gender equality policies, as increasing women's access to education and financial Well-being must be accompanied by changes in family roles and expectations so that women do not experience additional psychological burdens. A similar study was also conducted by Piao X., entitled "Impact of the Intra-household Education Gap on Wives' and Husbands' Well-being: Evidence from Cross-Country Microdata," which used data from 32 countries. Piao found that the educational gap within households negatively affected life satisfaction, especially for wives with higher education than their husbands. Conversely, husbands in similar circumstances actually showed higher levels of life satisfaction. These findings strengthen the evidence that traditional gender role norms remain highly influential in the social structure of many countries, and underscore the importance of policies that support the redistribution of domestic roles as women's educational participation increases.

e. Most Cited Document

The analysis of the most-cited documents aims to identify seminal works that have had a significant influence on the education gap literature. These documents represent conceptual and empirical foundations that have been widely referenced in subsequent research, both at the policy and practice levels.

Table 6. Most Cited Article

Paper	DOI	Total Citations	TC Per Year	Normalized TC
ALTINTAS E, 2016, J MARRIAGE FAM	https://doi.org/10.1111/jomf.12254	98	9.80	3.80
ATILES JT, 2021, EUR EARLY CHILD EDUC RES J	https://doi.org/10.1080/1350293X.2021.1872674	82	16.40	7.15
GOREN H, 2017, TEACH TEACH EDUC	https://doi.org/10.1016/j.tate.2017.05.009	80	8.89	5.24

Based on a bibliometric analysis of 190 documents in the Scopus database from 2015 to 2025, this study found that the main factors contributing to the education gap are socioeconomic status, digital inequality, teacher quality, and family background. The results of the bibliometric analysis using the Scopus database identified three articles with the highest citation rates on the theme of the education gap, each of which contributed significantly to the development of understanding of the education gap across various contexts. The first article by Altintas (2016) in the Journal of Marriage and Family, entitled "The Widening Education Gap in Developmental Child Care Activities in the United States, 1965–2013", with 98 citations, discusses the gap in developmental child care in the United States over nearly five decades. This study highlights differences in parental involvement in cognitive and social caregiving activities by educational attainment. It fills a gap by examining longitudinal studies and the involvement of fathers, especially those who do not live at home (Acharya et al., 2016). The findings show that caregiving involvement increases significantly among highly educated parents, especially mothers, thereby widening the gap with less educated groups. This article emphasises the urgency of intervention policies targeting low-educated families to encourage quality parenting involvement from an early age as a

strategy to prevent intergenerational educational gaps.

The second article, written by Atiles et al (2021) and published in the European Early Childhood Education Research Journal, entitled "International responses to COVID-19: challenges faced by early childhood professionals", with 82 citations, explores the experiences of early childhood education (PAUD) teachers during the COVID-19 pandemic in various countries, including Latin America and the United States. This study fills a gap in the literature by presenting practitioners' direct perspectives through a qualitative approach.

The results reveal the main challenges teachers face, including a lack of online training, technological access gaps, and increased psychological burdens. Children from underprivileged families were the group most affected by infrastructure limitations and parental involvement. The third article, written by Goren & Yemini (2017) and published in Teaching and Teacher Education, titled "The Global Citizenship Education Gap: Teacher Perceptions of the Relationship Between Global Citizenship Education and Students' socioeconomic Status," with 80 citations, examines the influence of students' socioeconomic backgrounds on the implementation of Global Citizenship Education (GCE) in Israel. This study shows that the successful implementation of GCE is highly dependent

Bridging Education Gap through Educational Innovation for Sustainable Development: A Bibliometric Analysis of the Scopus Database

107

on teachers' perceptions and agency, and is influenced by internal social inequalities.

Teachers from high-SES schools feel that students are more receptive to global values, whereas teachers from low-SES schools struggle to connect global concepts to students' realities. The implications of these three articles show that educational disparities occur not only in access and learning outcomes but also in social, emotional, and global citizenship values, requiring a more holistic, responsive policy approach that accounts for students' socioeconomic contexts.

f.   Top Countries and Affiliations

To examine the global distribution of research contributions, an analysis of top countries and affiliates was conducted. This section examines the countries and institutions most active and influential in publishing on educational inequality, providing insight into patterns of international collaboration and centers of research excellence in this area.

Table 7. Top Countries and Affiliations

Country	TC	Average Article Citations
USA	449	10.00
China	116	12.90
United Kingdom	114	22.80
Netherlands	85	10.60
Israel	80	80.00

Table 7. Country rankings based on authors who have contributed the most to the topic of educational disparities. The USA holds the best position with the highest total research citations of 449. China and the United Kingdom follow this with total citations of 116 and 114, respectively. Authors from the USA discuss educational and infrastructure disparities between urban and rural areas. This includes strategies to improve the urban-rural education gap through training and leveraging technology to foster inclusive education (Upreti & Malhotra, 2024). Furthermore, Corporate Social Responsibility (CSR) plays a crucial role in reducing educational disparities by contributing resources, skills, expertise, and sustainable solutions (Upreti & Malhotra, 2024).

g.   Knowledge Structure Analysis

Knowledge structure analysis was used to identify the evolution and dominance of research themes based on the frequency of keyword occurrences over time. This approach helps map how the focus of education gap studies has evolved and transformed within the global social, economic, and education policy context.
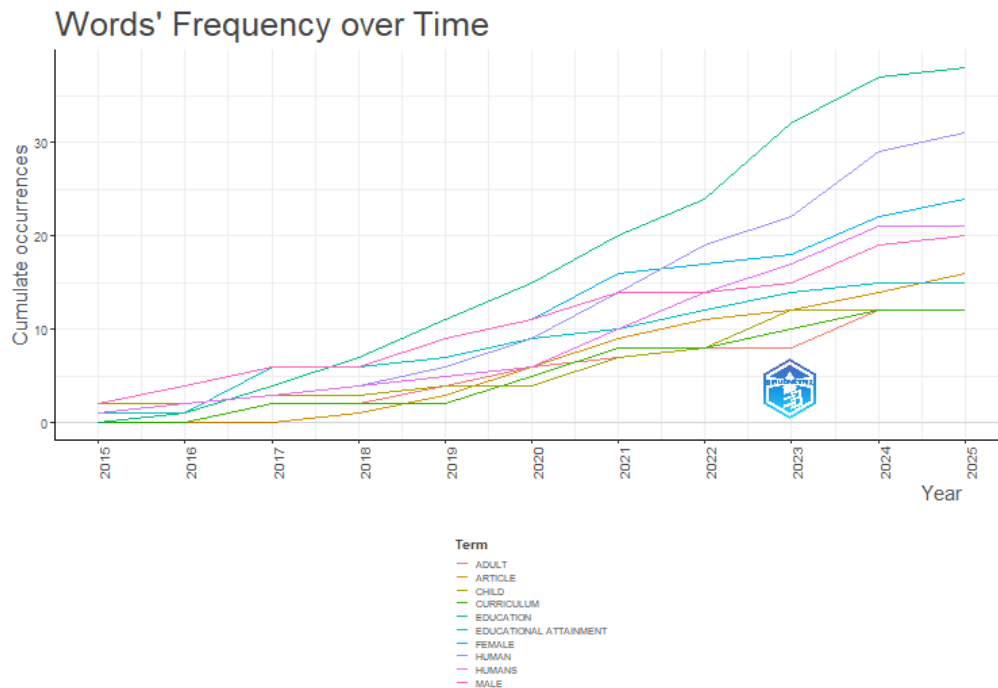
Words' Frequency over Time

Figure 4. Word's Frequency over Time

Figure 4. Illustrates the development of keywords related to educational disparities. The most developed context is, of course, education, which has continued to grow in the last decade. This is followed by educational attainment.

h. Conceptual Structure Analysis

To understand the conceptual relationships between research topics, a conceptual structure analysis was conducted through a keyword co-occurrence network. This section aims to uncover key thematic clusters, interrelationships between concepts, and the strategic position of specific themes within the research landscape on educational disparities and sustainable development.
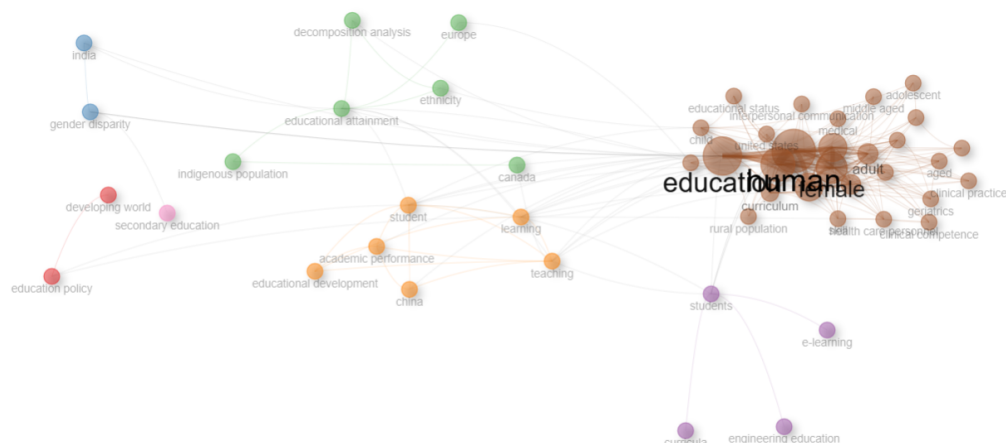

Figure 5. Co-occurrence Network

Figure 5. Presenting a collection of co-occurrence networks of publications on educational disparities, a visual representation depicts the relationships

Bridging Education Gap through Educational Innovation for Sustainable Development: A Bibliometric Analysis of the Scopus Database

109

among keywords in the collection. This co-occurrence network is organised into various thematic clusters, each grouping related terms that reveal key themes and existing research trends (Prahani et al., 2024). It is known that the keyword "Education" is closely related to "People."

Figure 6. Thematic Map

Another approach to analysing conceptual structure is through thematic maps (Figure 6), which visualise the various main themes within a research field. In this map, centrality represents the degree of interconnectedness or relevance of a theme to other themes. At the same time, density reflects the extent to which the theme has been developed or researched in depth. Based on the analysis, the emerging themes can be grouped into two main clusters and one cluster at the intersection, each consisting of several interrelated key terms or keywords, such as "cybersecurity education" and "sustainable development." In the motoric quadrant, some examples are "organisation and management" and "academic performance." In the emerging or declining quadrants, "indigenous people." Finally, some examples, such as "education level" and "educational status," are themes in the basic quadrant.

i. Countries' Collaboration Map

To better understand the global structure of scientific collaboration in education gap research, a country-level co-authorship analysis was conducted. This analysis maps international research partnerships based on joint publications indexed in Scopus, revealing how knowledge production in this field is distributed and interconnected across regions. Examining cross-country collaboration patterns helps identify leading contributor nations, regional research clusters, and the extent of international knowledge exchange. Such collaboration networks are important indicators of research capacity, global engagement, and the diffusion of ideas related to educational inequality and sustainable development. The visualisation of these partnerships is presented in the Countries' Collaboration Map (Figure 7).
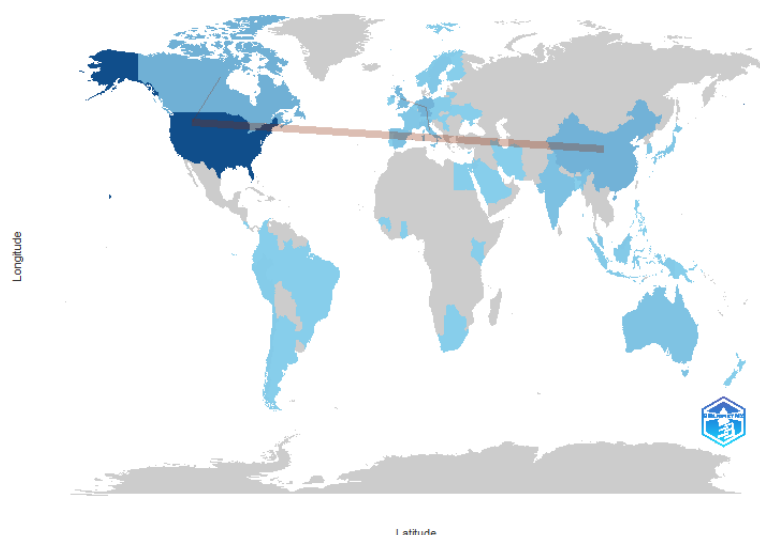
Figure 7. Countries' Collaboration Map

Figure 7 illustrates the network pattern of international collaboration in the field of adaptive learning, symbolised by the brown line. The most prominent collaboration is between the USA and China, as evidenced by strong bilateral ties in related scientific publications. This collaboration reflects the shared strategic research focus of both countries, particularly in the development of artificial intelligence-based learning technologies and big data for education. This strong relationship is also linked to the intensive academic exchanges and partnerships between universities and major research institutions in both countries (Glänzel & Schubert, 2004; Wagner et al., 2017).

Meanwhile, there are also smaller-scale collaborations, such as between Germany and Italy. Although less intense, these collaborations still play a role in strengthening the European region's contribution to the global literature on adaptive learning. Previous research has shown that such intra-regional collaborations tend to be influenced by similarities in education systems, scientific languages, and regional research funding policies, such as those of the European Union (Hoekman et al., 2010). The existence of these cross-border collaborations is crucial in expanding the diversity of methodological approaches and empirical findings, as well as encouraging the adoption of best practices across diverse educational contexts.

The education gap across countries is a complex, multidimensional issue influenced by socioeconomic factors, the quality of parenting, educators' competence, and the uneven distribution of infrastructure and digital access. Each country responds to these challenges through a variety of policies tailored to its respective context, such as counseling programs for parents and children in the United States. Furthermore, many countries have made Equity a top priority in their education policies (Lie et al., 2003). Countries such as Australia, New Zealand, Flanders, England, Scotland, South Korea, Singapore, the United States, Canada, Chile, and Mexico have designed and implemented educational Equity policies, which include the provision of scholarships, compensation funds, investments to reduce poverty, school integration based on socioeconomic background, education voucher schemes, and tax credit incentives (Andere., 2015). The findings of this study confirm that efforts to

reduce educational inequality do not only depend on expanding access to basic education and improving the quality of learning, but are also closely related to sustainable access to higher education, especially for students from low-income groups. This shows that educational Equity must be understood as a continuous process that encompasses all levels of education and requires comprehensive support from various stakeholders.

In the context of learning, teachers play a strategic role in developing students' character and competencies; however, research shows that parenting styles also significantly influence children's character development (Rakhmah et al., 2024). This consistency is reinforced by Angela et al. (2025), who found that critical thinking and self-efficacy are key determinants of increased student motivation to learn. On the other hand, digital competence has emerged as an important element in strengthening the curriculum to improve digital literacy and skills (Hidayat et al., 2024). The emphasis on interest-based teaching materials is also growing stronger, in line with previous research that highlights the urgency of developing higher-order thinking skills (Almubarak et al., 2025). Overall, integrating pedagogical factors, the role of the family, and digital readiness is crucial to the quality of education and the effectiveness of the learning process.

In the context of improving the quality and Equity of access to education, the student loan system policy can be considered as a relevant alternative strategy for Indonesia. Similar models have proven effective in various developed countries, such as the United States, the United Kingdom, and Australia (Barr et al., 2019; De Gayardon et al., 2019; Marks, 2009) through the Higher Education Loan Program (HECS-HELP) scheme. This scheme provides students with the flexibility

to defer tuition payments until they complete their studies and earn sufficient income, thereby removing economic barriers to continuing higher education. Therefore, this study emphasizes the importance of integrating student loan policy as an innovation that not only encourages higher education participation rates but also ensures equal opportunities, improves learning quality, and contributes to achieving sustainable development goals in the education sector.

4. Conclusion

This study presents a comprehensive bibliometric mapping of the literature on educational inequality from 2015 to 2025, encompassing 190 relevant articles. The results of this study highlight that educational inequality is a complex issue influenced by factors such as socioeconomic conditions, the quality of parenting, regional disparities between urban and rural areas, unequal access to digital technology, and educators' competence. The findings of this study emphasise that implementing a student loan policy can be a strategy to expand access to higher education. In addition, counselling programs for parents and students are needed to strengthen families' role in supporting their children's educational success. The challenges posed by the digital divide require the development of information technology infrastructure in rural areas to make digital-based educational transformation more inclusive. On the other hand, improving the quality of educators requires a more rigorous selection mechanism and appropriate placement based on expertise. Thus, efforts to overcome educational disparities must be formulated through integrative policies that encompass the economic, social, technological, and professional dimensions of educators, ensuring equal learning opportunities and supporting the achievement of sustaina-

ble development goals in the education sector.

For Indonesia, the policy implications include implementing student loan programs and an education loan system that allows students to defer tuition fees until they complete their studies. This policy not only helps equalise learning opportunities but also encourages social mobility. In addition, it needs to be balanced with collaboration among the government, financial institutions, and the private sector to provide funds and develop educational infrastructure, including digitisation in rural areas. Thus, efforts to reduce educational disparities require a more integrated, adaptive, and evidence-based approach to align with the achievement of SDG 4.

This study has limitations in its data sources, as it relies solely on the Scopus database, potentially excluding important literature from other databases and local publications. In addition, the analysis period is limited to a single decade, which means that long-term trends in educational inequality cannot be fully described. The bibliometric approach also emphasises publication quantity, citations, and topic relevance, so it does not explore the conceptual and methodological aspects of each article. Therefore, for future researchers, it is recommended to expand the data sources by combining multiple databases and to consider publications in Bahasa Indonesia to achieve a more comprehensive analysis. The research approach can also combine bibliometric methods with systematic literature review, meta-analysis, or mixed-methods approaches. In addition, the use of citation network analysis and keyword relationships helps identify research directions for the study. Further research can extend the analysis or period, or compare regions. The results of the analysis can be integrated with empirical data and education policy, ensuring that the findings are not only conceptual but also make a real contribution to achieving Sustainable Development Goal (SDGs) 4 on Quality Education.

5. References

Acharya, B., Hirachan, S., Mandel, J. S., & van Dyke, C. (2016). The mental health education gap among primary care providers in rural Nepal. Academic Psychiatry, 40, 667-671.

Allen, P., & Cutts, D. (2018). An analysis of political ambition in Britain. The Political Quarterly, 89(1), 73-81.

Almubarak, A., Saadi, P., Al Arief, Y., & Arini, D. N. (2025). Developing Interest-Based Teaching Materials in Chemistry Ed: Advancing Pedagogical Practices for Pre-service Teachers Engagement. *Indonesian Journal on Learning and Advanced Education (IJOLAE)*, 252–271.

Altintas, E. (2016). The Widening Education Gap in Developmental Child Care Activities in the United States, 1965-2013. *Journal of Marriage and Family*, 78(1), 26–42. https://doi.org/10.1111/jomf.12254

Angela, L., Handican, R., & Casanova, A. (2025). Linking Belief to Thought: a Structural Equation Modeling Analysis Of Self-Efficacy and Critical Thinking Among Indonesian Pre-Service Teacher. *Indonesian Journal on Learning and Advanced Education (IJOLAE)*, 393–410.

Asadullah, M. N., Savoia, A., & Sen, K. (2020). Will South Asia Achieve the Sustainable Development Goals by 2030? Learning from the MDGs Experience. *Social Indicators Research*, 152(1), 165–189. https://doi.org/10.1007/s11205-020-02423-7

Atiles, J. T., Almodóvar, M., Chavarría Vargas, A., Dias, M. J. A., & Zúñiga León, I. M. (2021). International Responses to COVID-19: Challenges Faced by Early Childhood Professionals. *European Early Childhood Education Research Jour-*

nal, 29(1), 66–78. https://doi.org/10.1080/1350293X.2021. 1872674

Badan Pusat Statistik. (2022, 25 November). *Statistik pendidikan* 2022 (No. 04200.2219). Badan Pusat Statistik Republik Indonesia. Diakses pada 16 Mei 2025, dari https://www.bps.go.id/id/publication/20 22/11/25/a80bdf8c85bc28a4e6566661/st atistik-pendidikan-2022.html

Barr, N., Chapman, B., Dearden, L., & Dynarski, S. (2019). The US college loans system: Lessons from Australia and England. *Economics of Education Review,* 71, 32–48.

Bozkurt, A., Karakaya, K., Turk, M., Karakaya, Ö., & Castellanos-Reyes, D. (2022). The Impact of COVID-19 on Education: A Meta-Narrative Review. *TechTrends,* 66(5), 883–896. https://doi.org/10.1007/s11528-022-00759-0

Broer, M., Bai, Y., & Fonseca, F. (2019). Socioeconomic Inequality and Educational Outcomes. *In Life Sciences* (Vol. 16, Issue 12).

De Gayardon, A., Callender, C., & Green, F. (2019). The determinants of student loan take-up in England. *Higher Education,* 78(6), 965–983.

Demetriou, A. (2020). Bridging the Twenty-first Century Gap in Education - History, Causation, and Solutions. *European Review,* 28(S1), S7–S27. https://doi.org/10.1017/S106279872000 0873

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to Conduct A Bibliometric Analysis: An Overview and Guidelines. *Journal of Business Research*, 133, 285–296.

Filmer, D., Rogers, H., Angrist, N., & Sabarwal, S. (2020). Learning-Adjusted Years of Schooling (LAYS): Defining a New Macro Measure of Education. *Economics of Education Review*, 77(January 2019), 101971. https://doi.org/10.1016/j.econedurev.202 0.101971

Fitri, S. F. N. (2021). Problematika Kualitas Pendidikan di Indonesia. *Jurnal Pendidikan Tambusai,* 5(1), 1617-1620.

Glänzel, W., & Schubert, A. (2004). Analysing Scientific Networks Through Co-Authorship. In Handbook of Quantitative Science and Technology Research: The Use of Publication And Patent Statistics *In Studies Of S&T Systems* (pp. 257–276). Springer.

Goren, H., & Yemini, M. (2017). The Global Citizenship Education Gap: Teacher Perceptions of the Relationship Between Global Citizenship Education and Students' Socio-Economic Status. *Teaching and Teacher Education*, 67, 9–22. https://doi.org/10.1016/j.tate.2017.05.00 9

Hassan, A., Afrouzi, H. N., Siang, C. H., Ahmed, J., Mehranzamir, K., & Wooi, C.-L. (2022). A Survey and Bibliometric Analysis of Different Communication Technologies Available for Smart Meters. *Cleaner Engineering and Technology,* 7, 100424. https://doi.org/https://doi.org/10.1016/j.c let.2022.100424

Hidayat, M. L., Abdurahman, S. G., Astuti, D. S., Prabawati, R., Anif, S., Hariyatmi, H., & Zannah, F. (2025). Pilot Study of Digital Competency Mapping of Indonesian Preservice Teachers: Rasch Model Analysis. *Indonesian Journal on Learning and Advanced Education (IJOLAE)*, 100-116.

Hoekman, J., Frenken, K., & Tijssen, R. J. W. (2010). Research Collaboration at a Distance: Changing Spatial Patterns of Scientific Collaboration Within Europe. *Research Policy,* 39(5), 662–673. https://doi.org/https://doi.org/10.1016/j.r espol.2010.01.012

Jafar, K., Ananthpur, K., & Venkatachalam, L. (2023). Digital Divide And Access to Online Education: New Evidence from Tamil Nadu, India. *Journal Of Social And Economic Development*, 25(2), 313–333. https://doi.org/10.1007/s40847-023-00236-1

Leseman, P. P., & Slot, P. L. (2020). Universal Versus Targeted Approaches to Prevent Early Education Gaps. The Netherlands As Case in Point. *Zeitschrift für Erziehungswissenschaft,* 23(3), 485–507.

Liao, P. J., Wang, P., Wang, Y. C., & Yip, C. K. (2022). Educational Choice, Rural–Urban Migration, and Economic Development. *Economic Theory*, 74(1), 1–67. https://doi.org/10.1007/s00199-021-01369-2

Lie, S., Linnakylä, P., & Roe, A. (2003). *Northern lights on PISA: Unity and diversity in the Nordic countries in PISA 2000*. University of Oslo, Department of Teacher Education and School Development

Ma, X., & Piao, X. (2019). The Impact of Intra-Household Bargaining Power on Happiness of Married Women: Evidence From Japan. *Journal of Happiness Studies,* 20, 1775-1806.

Malik, R. S. (2018). Educational Challenges in 21St Century and Sustainable Development. *Journal of Sustainable Development Education and Research*, 2(1), 9. https://doi.org/10.17509/jsder.v2i1.12266

Marks, G. N. (2009). The Social Effects of the Australian Higher Education Contribution Scheme (HECS). *Higher Education,* 57(1), 71–84.

Nguyen, H. T. M. (2019). Ethnic Gaps in Child Education Outcomes in Vietnam: an Investigation Using Young Lives Data. *Education Economics*, 27(1), 93–111. https://doi.org/10.1080/09645292.2018.1444147

Phan, D., & Coxhead, I. (2020). Persistent Privilege? Institutional Education Gaps During Vietnam's Economic Boom. *The Developing Economies*, 58(4), 332–359.

Piao, X., Ma, X., & Managi, S. (2021). Impact of the Intra-Household Education Gap On Wives' and Husbands' Well-Being: Evidence From Cross-Country Microdata. *Social Indicators Research*, 156, 111-136.

Prahani, B. K., Rizki, I. A., Suprapto, N., Irwanto, I., & Kurtuluş, M. A. (2024). Mapping Research on Scientific Creativity: A Bibliometric Review of the Literature in the Last 20 Years. *Thinking Skills and Creativity,* 52(March). https://doi.org/10.1016/j.tsc.2024.101495

Rahmiaty, R., Kamarullah, K., Rahman, F., Haekal, M., & Hadi, W. (2025). Modernizing Higher Education in India: Quality Dimensions for Sustainable and Impactful Education. *Indonesian Journal on Learning and Advanced Education (IJOLAE),* 272–294.

Rakhmah, R., Niron, M. D., & Jha, G. K. (2024). Beyond the Classroom: A Comprehensive Analysis of Teacher Personality Competence, Parenting Styles, and Their Joint Influence on the Character Formation in Junior High School Education. *Indonesian Journal on Learning and Advanced Education (IJOLAE),* 156-169.

Rasaili, W., Dafik, D., Hidayat, R., & Prayitno, H. (2021). Analysis of the Influence of Local Politics on Implementation SDGs 4 Policy for Quality Education. *SAR Journal* (2619–9955), 4(4).

Sahyar, Bunawan, W., Rangkuti, M. A., & Yanti, J. (2020). High-Level Comprehension Skill by using Competencies PISA in Indonesia's Education System. *384(Aisteel),* 737–741. https://doi.org/10.2991/aisteel-19.2019.169

Shehaj, A. (2022). Revolutionized Learning: Education Policy and Digital Reform in the Eurozone. *European Policy Analysis*, 8(3), 312–326. https://doi.org/10.1002/epa2.1158

UNESCO. (2022). Global Education Monitoring Report 2022: Gender Report.

Upreti, H., & Malhotra, R. K. (2024). Bridging The Urban-Rural Education Gap In India Through CSR (Corporate Social Responsibility) Initiatives: A Conceptual Study With Special Reference To Sustainable Development Goal 4 (Quality Education). *E3S Web of Conferences,*

556. https://doi.org/10.1051/e3sconf/2024556 01032

Wagner, C. S., Whetsell, T. A., & Leydesdorff, L. (2017). Growth of International Collaboration in Science: Revisiting Six Specialties. *Scientometrics,* 110(3), 1633–1652. https://doi.org/10.1007/s11192-016-2230-9

Waltman, L., & van Eck, N. J. (2012). A New Methodology for Constructing A Publication-Level Classification System of Science. *Journal of the American Society for Information Science and Technology,* 63. https://doi.org/10.1002/asi.22748

Wang, X., Luo, R., Zhang, L., & Rozelle, S. (2017). The Education Gap of China's Migrant Children and Rural Counterparts. *Journal of Development Studies,* 53(11), 1865–1881. https://doi.org/10.1080/00220388.2016.1274395

Wei, C., & Chen, J. (2024). How do Higher Education Policies Influence the Shaping of Sustainable Development Values in China: A Three-Dimensional Framework. *Frontiers In Environmental Science,* 12(October), 1–14. https://doi.org/10.3389/fenvs.2024.1481652

Widiasanti, I., Astriani, D., Rahayanti, A. E., Septianto, B., & Widianingsih, L.

(2023). Analysis of E-Learning Activities as School Learning Media in the Era of Society 5.0 Using Big Data. *Edunesia: Jurnal Ilmiah Pendidikan*, 4(3), 1082–1096. https://doi.org/10.51276/edu.v4i3.438

Wulandari, W., Rafsanjani, M. A., Andriyansah, E. H., & Prakoso, A. F. (2025). Education, equity, and inclusion: Teaching and learning for a sustainable north. *Review of Education, Pedagogy, and Cultural Studies*, 47(3), 513–516.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic Review of Research on Artificial Intelligence Applications in Higher Education–Where Are the Educators? *International Journal of Educational Technology in Higher Education*, 16(1), 1–27.

Zhang, J., Jin, S., Torero, M., & Li, T. (2018). Teachers and urban-rural gaps in educational outcomes. American Journal of Agricultural Economics, 100(4), 1207-1223.

Zhang, Y. (2024). Factors influencing rural educational investment under the digital divide: A QCA study.

Zhang, Y., Ma, G., Tian, Y., & Dong, Q. (2023). Nonlinear Effect of Digital Economy on Urban–Rural Consumption Gap: Evidence from A Dynamic Panel Threshold Analysis. *Sustainability*, 15(8), 6880.