Journal of Intercultural Management
Vol. **15** | No. **3** | **2023**
pp. **107–124**
DOI **10.2478/joim-2023-0013**

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The Role of Education in the Development of Human Capital: A Bibliometric Analysis of Literature Outputs in 1990–2023

Received: 27-09-2023; Accepted: 29-11-2023; Published: 27-12-2023

ABSTRACT

Objective: Comprehensive overview of the most relevant topics, trends, and scientific products in the field of the relationship between education and human development.

Methodology: Bibliometric (VOSviewer v.1.6.10) analysis were used to describe thematic, temporal patterns, clustering of concepts and research networks (geographical and institutional aspects).

Findings: The study provides a comprehensive overview of the state of research on education's role in human capital development, offering summarized insights into global trends, thematic shifts, and key contributors to the field.

Value Added: The article contains quantitative methodological approach to studying current topics and developing research on the impact of education on human development, which is interdisciplinary and covers a large volume of publications. The article defines research thematic and evolutionary-temporal patterns, carries out clustering of research networks according to the affiliation of scientists (geographical and institutional aspects), and identifies leaders of scientific opinion in this field.

Recommendations: Future research may focus on developing a list of measurable indicators suitable for evaluating the role of education in human development, and social and economic determinants to avoid cognitive biases or irrational and distorted decision making by mainstream agents.

Key words: education, human capital, economic growth, bibliometric analysis, science mapping.

JEL codes: I20, I25, N3, J24

Introduction

Human capital is one of the critical macro factors of economic growth. Accordingly, a strategy for its development is integral to economic, social, and employment policies. A solution taking into account all those aspects ensures the achievement of one of the Goals of sustainable development – the promotion of progressive, comprehensive, and sustainable economic growth, full and productive employment, and decent work for all. An individual's high level of potential contributes to their productivity potential for economic and personal growth and adaptability to changes. From employers' point of view, human capital contributes to their productivity and competitiveness through the critical assets people possess – their knowledge, skills, and abilities acquired through the education system. An effective education system will allow individuals to obtain qualifications, ensure personal development, increase labor market competitiveness, improve mobility and social integration, and increase self-esteem. Human capital development enhances these attributes through education, training, and personal development.

Becker's pioneering work *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education* (in three editions, 1964, 1975, and 1994) laid the foundation for understanding the relationship between education and human capital. He introduced the concept of human capital and argued that investment in education leads to increased productivity and economic growth. Becker's analysis emphasized the role of education in improving people's skills and knowledge, thereby increasing their income potential and overall economic well-being. Weiss (2015) defined Becker as constructing a detailed and original theory regarding the possible effects a major unobserved and all-inclusive factor, human capital, would have on observed outcomes such as wages and education and their variation over time and among individual types.

Mincer's research (1981, 1984) focused on the economic returns of education and its impact on individual economic (income) growth and the social or national aggregates. Mincer's works highlighted the long-term benefits of education in terms of income inequality reduction and social mobility, the production

of new knowledge, which is the source of innovation, and technical change, which propels all factors of production.

Psacharopoulos and Patrinos (2004) reviewed the macroeconomic literature on returns from education. They summarized numerous studies from different countries and found strong evidence of a positive correlation between education and individual earnings. Their research reinforced that education performs a critical role in human capital development and has significant economic implications.

Hanushek and Woessmann (2010) examined the impact of education on economic growth using international data. They found a strong relationship between educational quality, measured by student achievement scores, and economic growth. Their research emphasized the importance of increasing educational attainment and improving the quality of education to maximize the benefits of human capital development.

There is also an active debate in the scientific literature regarding the limitations of the human capital theory and its impact on social and economic development. Sweetland (1996) comprehensively reviewed human capital theory's foundations and fundamental concepts. He explored the relationship between education, investment in human capital, economic performance, and social inequality. Sweetland discussed the exclusion of non-economic aspects of education and its limitations in reflecting the complexity of human capital formation. He emphasized the need for interdisciplinary approaches to studying human capital and the importance of considering sociocultural factors in understanding its development and results.

Tan (2014) critically examined the human capital theory and argued that it overlooks the broader social and contextual factors that shape educational outcomes. The author discussed the need to account for the social, cultural, and structural influences on human capital development. He argued that a heavy emphasis on economic returns and outcomes neglects other essential dimensions of human development, such as personal fulfillment, social well-being, and the broader contributions individuals make to society beyond their economic productivity.

Marginson (2019) examined the human capital theory, criticizing its narrow economic focus and the contextual factors that shape educational outcomes and emphasizing the need to consider ethical and social dimensions. In his opinion, a finer understanding of education and human capital is required that recognizes the complexity and diversity of educational goals today. He saw the need for a more comprehensive understanding of education that recognizes various forms of knowledge, skills, and abilities, including those outside the economy.

During the last decade, researchers have had significant scientific results from studies on education's role in human capital development. These investigations provide valuable information to the research area and formulate recommendations to promote the best practices. Therefore, a bibliometric analysis of these articles is required to integrate all the studies in the chosen research area.

The paper aims to comprehensively analyze articles focused on education's role in human capital development. Using VOSviewer, global research trends from 1990 to 2023 were summarized and used to guide future research. Therefore, a bibliometric analysis will provide a comprehensive system for investigating articles on education's role in human capital development, including relationships with other topics and the most relevant publications.

The paper consists of the following sections. The first introductory section provides a background for the research, its purpose, and the methodology. Further, the second section presents the results of the bibliometric analysis, divided into three blocks. The first block characterizes thematic issues (reasons and periods of change in the interest in the role of education, dominant directions of scientific research in this area, interdisciplinary research); the second block describes evolutionary time ones (in the coordinate system "period of research – its substantive focus – its geography"), in the third block, a clustering of research networks according to the affiliation of the scientists (geographical and institutional aspects) was carried out, and leaders of scientific opinion in this area were identified. The third section entails a discussion of the results, limitations, and a conclusion to the research.

Methodology

The article uses bibliometric (VOSviewer v.1.6.10) analysis based on the Scopus database, a relevant base for social and economic research.

At the preparatory stage, a search for articles was carried out in the Scopus database. The author carried out the search in March 2022; keywords – "education" and "human capital"; period – from 1990 to 2023; publication language – English; source type – journal. As a result, 8954 articles in peer-reviewed journals in English were selected from 1990 to 2023. The information obtained at this stage was exported to an Excel spreadsheet for further analysis and systematization. The database contains various parameters, including author names, cited publications, journal names, sponsoring organizations, country of publication, and keywords.

In the next stage, this database was analyzed using VOSviewer. This tool allows clustering studies by topic and keywords and identifying and analyzing large amounts of scientific information. Keywords obtained from publications that had a high correlation with each other were included in the corresponding cluster.

Results

The first block is a thematic analysis based on keyword matches to visualize key aspects of the study on the education impact on human capital development, with a minimum of two repetitions of keywords as a threshold value for the study (Figure 1). A larger circle diameter means a higher frequency of mention of the corresponding concept as a keyword in articles indexed by the Scopus database during the analysis period.

Figure 1. Results of a bibliometric analysis: a cluster thematic map

Source: own elaboration.

A map of the relationship between «education» and other categories was formed, making it possible to identify four clusters marked in the figure with green, red, blue, and purple colors. The main body of scientific research is focused on identifying the relationships between the role of education in the development of human capital (red cluster), human characteristics (blue cluster), parameters characterizing the level of education development (green cluster), substantiating the role of education in various socio-demographic processes (purple cluster). There are intersections and interconnections between the identified clusters, namely economic growth and economic and regional development, as well as the development of social and intellectual capital significantly depend on education and human potential, the impact of education on which is also partially compatible; an essential role in the development of human capital is performed by the level of education, educational policy, and the development of education; in turn, the personal characteristics of

individuals have practically no relationships with other clusters, despite the significant variety of categories in them.

Although the research covers a significant number of vectors of scientific research, the fundamental one is the formalization of the impact of education on the development of human capital and economic growth.

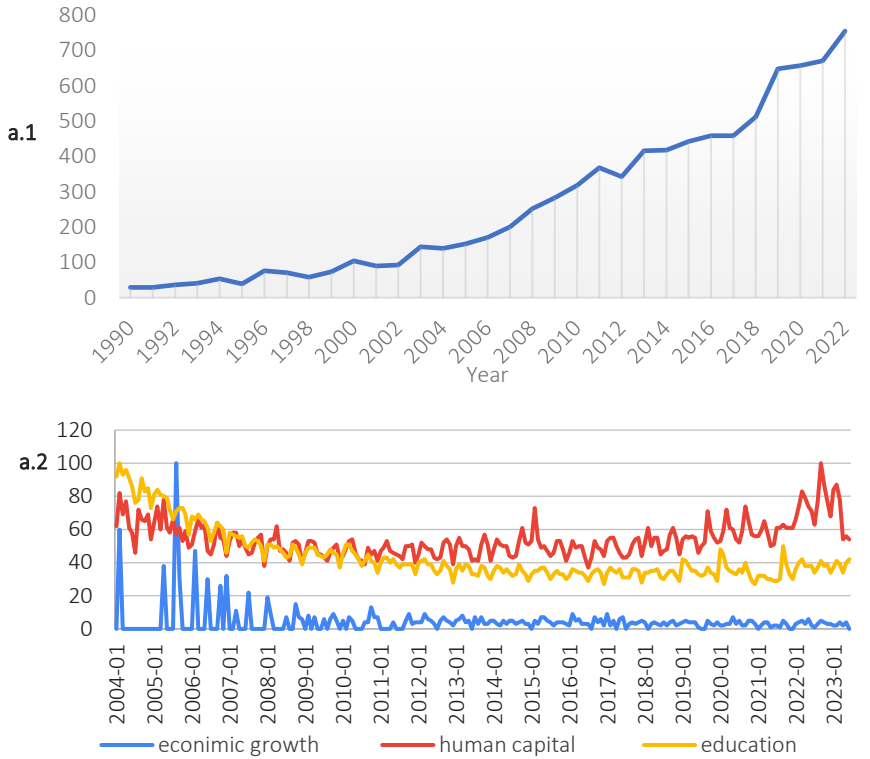
The second block includes an analysis of research results divided into trends in selected topics, conducted both in a social context (using Google Trends tools) and in an academic context (Figure 2).

Figure a.1 presents the temporal distribution of articles in Scopus, covering the years from 1990 to 2022. The average number of studies published annually is 260, and the median is 185 articles.

The observed period was divided into three shorter ones, depending on the volume and volatility of the number of publications. In the first period, from 1990 to 2005, 1224, or 13.67 %, of the analyzed publications were published, an average of 94 articles per year. In the second period, from 2006 to 2012, 1934, or 22.50 % of the selected articles were published. On average, 276 papers were published per year during this period, and the year with the most significant number of publications was 2011, when 368 studies were published. In the third period, from 2013 to 2022, 5437 articles were published, which is 63.24 % of the total articles. On average, 543 articles were published annually, and the peak was reached in 2022 when 755 articles were published.

The analysis of the results using Google Trends allow assessing the relevance and popularity of a given topic in web searches. The data presented show that although there is a significant interest in this topic in society, there is less growth than in the case of research interest.

Figure 2. Comparison of scientific publications in the Scopus (a.1) and the dynamics of Google searches (a.2) on issues of education, human potential, and economic growth



Source: own elaboration.

Correlation analysis did not reveal a connection between changes in the interest in this area in society and the academic environment, which allows concluding that different factors determine them.

Therefore, according to the analysis results, it was established that the intensity of scientific research on the role of education in the formation of human potential has been constantly increasing during 1990–2022. This is due to the recognition of its influence on economic and social characteristics both at an individual level and at the levels of regions and countries.

The thematic-temporal block of the bibliometric analysis was used for expanding the evolutionary-temporal perspective of the study. Based on this, the main

substantive determinants of research questions were ranked from 2005 to 2023. The analysis period is shortened compared to the thematic block of the bibliometric analysis due to the relatively small number of publications on the relevant issues from 1990 to 2012. The gradient in Figure 3 changes from blue – the earliest works, to yellow – modern works.

Figure 3. Thematic-temporal dimension of research

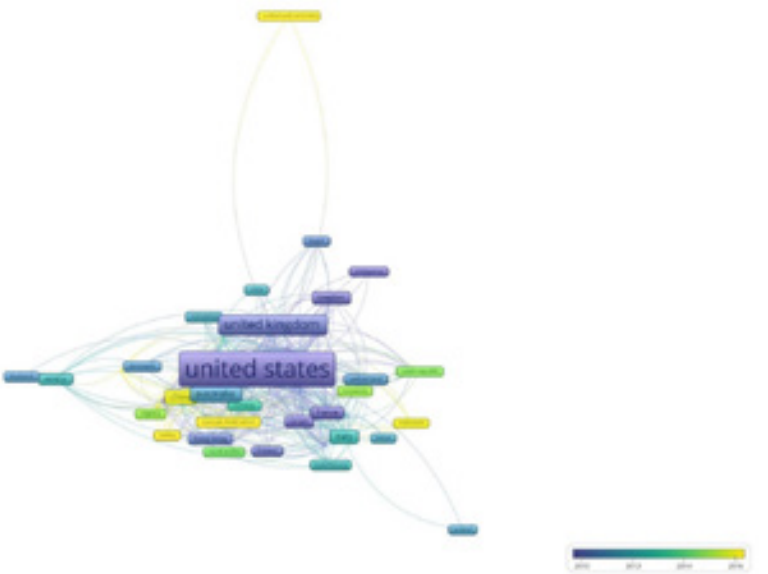
Source: own elaboration.

According to the results of the thematic-temporal block of research, there are three stages during which the main emphasis in this area changed. In 2006 2008, research was not active, scientists mainly considered separate issues of education, demography, labor market. In 2009–2012, the interest of researchers was directed to the formation of the human capital theory in connection and interdependence with economic growth and education, and the most significant scientific foundation in this field was formed. Since 2012, research has been focused on individual objects (such as technology transfer, patents, and innovation) without a close connection to the central areas of research. Summarizing, it can be

noted that human capital influence extends beyond the borders of the economic system, causing the activation of synergistic mechanisms in various spheres of social life. In this regard, human potential development cannot be considered separately from the economic, educational, and social policy of the state but, on the contrary, should consider the existing direct and reverse diffuse and transmission processes in this area.

Within the framework of the time perspective of the bibliometric analysis of educational research, its spatial component was studied (Figure 4).

Figure 4. Country network analysis of scientific production and work collaboration



Source: own elaboration.

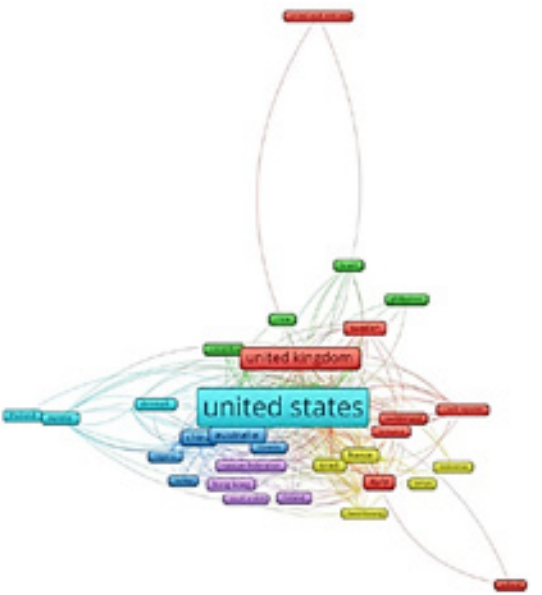
According to the results of the spatiotemporal bibliometric analysis, it was established that the intensification of research on the role of education takes place in the countries of the world during 2006–2023 within the framework of four consecutive time ranges, which has its geographical centers. A pattern can be noted: earlier studies (purple and blue clusters) occurred in industrially developed countries with a high GDP per capita (exceptions are the Philippines

and Kenya). In contrast, in the second half of the studied period (green and yellow clusters), the research geography expanded to include less economically developed countries (China is the exception).

The third block presents the results of research network clustering, according to the affiliation of the scientists (geographical and institutional aspects), identifying leaders of scientific opinion in this area.

Figure 5 provides a visual database of countries that have published research on the role of education in human development, showing changes over time and geographic connections in this area. The size of the cluster is determined by both the number of publications and the number of citations and co-citations.

Figure 5. Map of co-authorship of the scholars (criterion – country, designated in the affiliation)



Source: own elaboration.

Based on the spatial clustering results, six groups of countries were identified, researchers from which have joint publications on the education's role in human potential development, namely:

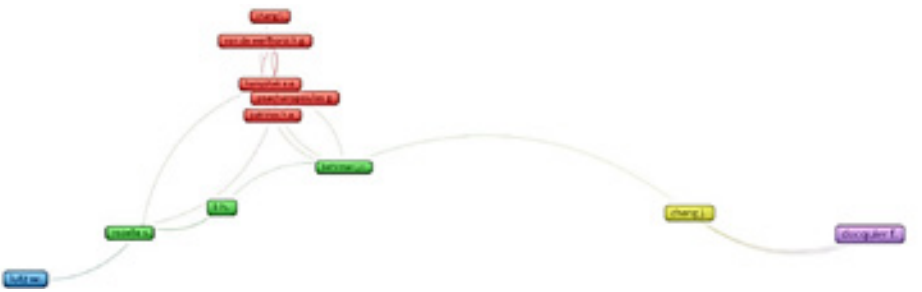
1. United States (research center), Denmark, Thailand, and Austria,
2. United Kingdom (research center), Sweden, Switzerland, Italy, Poland, the Czech Republic, Romania, and the UAE,
3. France, Luxembourg, Israel, Kenya, Indonesia,
4. Colombia, Chile, Brazil, and the Philippines,
5. Russia, Hong Kong, Saudi Arabia, and Finland,
6. Nigeria, Turkey, China (research center), Australia, and Norway.

As data show, connections between the researchers on the education's role in human potential development are usually not formed by geographical proximity; clusters (except clusters 2 and 4) unite representatives of the scientific community from different continents.

In this context, it should also be noted that from the total volume of scientific publications indexed by the Scopus database, the most significant number of works for the period 1990–2023 was recorded with affiliation to the United States (2420; 21.14 %), United Kingdom (777; 6.79 %), China (657; 5.74 %).

A formalization of the research network studying the role of education in shaping human potential is presented in Figures 6 and 7.

Figure 6. Map of the research network structure based on the analysis of co-citations in publications indexed by Scopus



Source: own elaboration.

The formalization of the research dimension on the education's role in human potential development has proven the existence of five research schools that are international and interdisciplinary. The flagship studies are Hanushek (1979, 2011), Hanushek & Woessmann (2007, 2010), Glomm & Ravikumar (1992, 1998), Psacharopoulos & Patrinos (2004, 2018, 2020), Behrman (1983), Beine, Docquier, & Rapoport, H. (2001, 2008), Doquier, & Rapoport (2012), Lutz & Kc (2011), Zhang, Huang, & Rozelle (2002), Zeng et al. (2014).

It was established that the most significant number of works on the specified issue was published by scientists affiliated with the following research centers: World Bank, National Bureau of Economic Research (United States); Center for Economic Policy Research (United Kingdom); Institute of Labor Economics, CESifo (Germany).

The representation of higher education institutions is also significant: University Colleges Dublin, University Colleges London, the University of Amsterdam, Michigan State University, Arizona State University, Harvard University, and others.

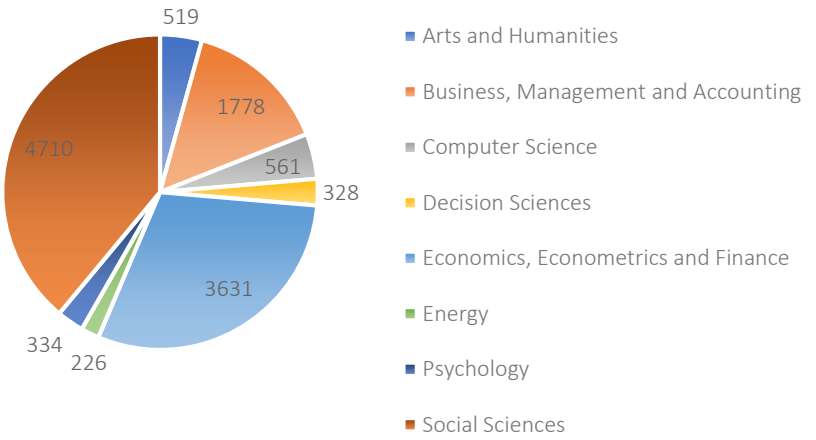
Figure 7. Map of the scientists' co-authorship (criterion – institution – place of affiliation of the researcher), whose joint publications on education issues are indexed by Scopus

Source: own elaboration.

The obtained data confirm the preliminary conclusion that the centers of scientific thought in this field are the United States of America and the United Kingdom, where the most significant number of scientists and institutions deal with the issue of the impact of education on the social and economic systems.

It should be emphasized that the branch affiliation of the analyzed publications is quite diversified (Figure 8).

Figure 8. Structure of the subject area of scientific publications on education indexed in Scopus



Source: own elaboration.

Naturally, most empirical studies on education issues are concentrated in the field of social sciences (53 %), economics, econometrics, and finance (41 %), as well as business, management, and accounting (20 %).

Conclusions

According to the results of the bibliometric analysis, it was found that research on the role of education in the development of human potential occupies a prominent place in the system of socio-economic research, scientific and user interest, which is constant.

This allows concluding that at the current stage of the development of society, one of the main priorities of the implementation of state policy in the world's countries is the formation of an effective education system that will ensure economic growth and social development. Research in this field transforms over

time. If, at the initial stages of the emergence of the scientific interest in this issue, the main emphasis was placed on education, then gradually, the defined issue began to acquire a broader perspective, covering the role of education in ensuring the development of the economic and social systems, the quality of human life. At the current stage of development, research goes beyond the traditional spectrum. Theoretical and empirical searches regarding the formalization of the impact of education on the formation of innovative potential, environmental sustainability, and ensuring sustainable development, in general, are gaining increasing popularity.

A limitation of the study is that the data were obtained only from journal articles written in English and listed only in the Scopus database. On the one hand, the study became representative since high-quality articles were used. On the other hand, due to the specifics of the database, scientists' access to it is limited due to language and financial barriers. In the future, it may be advisable to combine data from different sources, including Web of Science, Google Scholar, and non-English language articles.

The analysis shows that most of the studies in the sample were conducted in highly developed countries (USA, UK, Australia, Sweden, etc.). However, education sectors worldwide have significant differences, both quantitative and qualitative (level of funding, technology implementation, digitalization, and innovation). Cross-country studies will provide a better understanding and open broad opportunities for research into the impact of education on human development in the country.

Summarizing the above, it can be noted that the analysis made it possible to generalize the theoretical aspects of the influence of education on the development of human potential in a comprehensive manner, formalized according to some important parameters (thematic, evolutionary, spatial, etc.), which forms the basis for further empirical research in this direction.

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