Bibliometric Analysis of Research on Heuristic Method, Research Skills and Teaching Practice in Higher Education: A Perspective from Online and Blended Learning based on Scopus Database (2013- 2023)

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Abstracts

The present study conducted a detailed bibliometric analysis focused on research related to Heuristic Method, Research Skills and Teaching Practice within the framework of Higher Education. For this purpose, the Scopus database was used, considering publications from 2013 to 2023. The initial analysis revealed a total of 4071 relevant records. Of these, research articles constituted the largest proportion with 60.1%. Given the relevance and volume of these articles, 2488 were selected for further analysis. However, after a filtering process, it was decided to work with 2363 articles. A crucial observation of the study is the prominence of the Social Sciences in this field. With 1,693 articles, the Social Sciences accounted for a significant 39.9% of the total number of publications analyzed. This data suggests a notable inclination towards the Social Sciences when addressing the above-mentioned topics in the field of higher education. It also reflects the interdisciplinarity and diversity of approaches in contemporary educational research. It is essential to note that the methodology adopted in this study, based on bibliometric tools and the Scopus database, provides a robust and up-to-date overview of trends in educational research over the last decade. These findings are crucial for scholars, researchers and practitioners in education to understand the dynamics and recent evolutions in the field.

Keywords: Heuristic Method, Research Skills, Teaching Practice, Higher Education, Online Learning.

Introduction

In the last decade, the dynamics of learning in higher education have undergone significant changes, largely driven by the digital revolution and the need for more flexible and adaptive teaching methods. The use of online education system not only provides economic advantages, but also additional environmental benefits, making online education a possibly more environmentally friendly alternative (Deaconu et al., 2022; Lima & Hwang, 2023). In particular, online and blended learning have gained ground as modalities that offer a combination of traditional classroom interaction and digital elements, allowing students to access resources and materials from anywhere and at any time (Chamizo & Garcia-Franco, 2013; Molefe & Mabunda, 2022). In addition, the use of online learning is an effective strategy to facilitate teaching and learning in higher education institutions. Heuristic method, research skills, and teaching practice have become areas of growing interest for educators and researchers. These components not only influence the quality and effectiveness of the educational process, but also determine how students adapt and respond to these new teaching formats. Despite the importance of these topics, there is a lack of consolidated studies that offer a panoramic view of the existing literature. Therefore, the present article seeks to fill this gap by conducting a comprehensive bibliometric analysis based on the Scopus database, covering a ten-year period, from 2013 to 2023.

The constant evolution of the educational landscape has led institutions and educators to pay special attention to methods that promote autonomous and critical learning. The Heuristic Method, with its focus on discovery and exploration, has positioned itself as an essential pedagogical tool. Its effectiveness in online and blended learning environments has stood out, offering opportunities for students not only to acquire knowledge, but also to develop reasoning and problem-solving skills (Eryilmaz, 2015).

The avalanche of information available in the digital age demands that students be equipped with robust research skills. These skills are not only essential for academia, but also prepare students to navigate and evaluate information in an increasingly interconnected world.

The integration of these skills in higher education, especially in online modalities, is critical to developing informed and critical individuals (Guclu, 2016).

While online and blended learning offers multiple advantages, it also poses unique challenges for teaching practice. Educators now face the task of adapting their pedagogical strategies to digital platforms while ensuring quality and effective interaction. This transition has led to a re-evaluation of teaching practice, with a focus on including innovative techniques and adaptive methods that respond to the changing needs of learners (Abdullah & Shariff, 2008).

State of the Art

Technological progress in the last decade has permeated various areas of daily life, and education has been the exception, indicating that it has experienced significant growth to meet the growing demand for continuing and professional education. Online and blended learning, which has emerged in response to the changing needs of students and society, has been the subject of numerous studies in recent years (Altowairiki, 2023; Kaur et al., 2021).

The heuristic method has been identified as an essential tool in this new educational landscape. Online higher education globally has the potential to raise the quality of higher education. They foster collaboration and progress in education at the international level, and play a more effective role in driving the knowledge-based economy (Hernández-Gómez et al., 2019; Zhou, 2023).

With respect to teaching practice, changes in the educational paradigm have required constant adaptation and updating of educators. It is important that teachers are constantly trained and updated in the use of virtual reality in order to adapt to the needs and demands of 21st century education. Despite the proliferation of individual research in these areas, the literature lacks holistic studies that integrate these components and provide a global view of their evolution and trends. This research seeks to fill this void, offering a consolidated perspective through a bibliometric analysis (Antón-Sancho et al., 2023; Zhao et al., 2021).

As online and blended learning have gained traction, researchers have sought to understand the dynamics underlying these modalities. The quality of the technological infrastructure, as well as the digital skills of learners (Mohammed Hassan Al-Ahdal et al., 2022) "for the

flexibility it provides" by eliminating the need to physically attend a classroom and allows students to structure their learning according to their personal and professional commitments.

In the field of online higher education, new pedagogical modalities have been identified to optimize both learning and student engagement. These innovative modalities, ranging from gamification to project-based learning and personalized tutorials, are perfectly aligned with the particularities of digital learning, seeking to capitalize on its multiple benefits (Lima & Hwang, 2023).

One focus of interest for researchers has been to understand the nature of interaction in virtual learning environments. Unlike traditional classrooms where interaction occurs spontaneously, in digital environments it is essential to design specific strategies that promote a collaborative construction of knowledge. In this context, virtual learning communities emerge as fundamental platforms for peer-to-peer exchange and collaboration, thus enriching the educational experience (Gray et al., 2019).

Assessment on virtual platforms introduces challenges that go beyond the mere adaptation of traditional methodologies to the online world. Aspects such as authenticity, integrity and fairness in assessment become especially relevant. In view of this, various tools and techniques have been devised, including anti-plagiarism systems and constant formative assessment mechanisms, seeking to ensure that online assessment maintains a robustness and meaning comparable to face-to-face modalities. (Saleh et al., 2023).

The Heuristic Method has proven to be especially relevant in the context of digital education. Students, faced with an avalanche of data and resources, require heuristic skills to discern and select relevant information.

On the other hand, research skills, although they have always been fundamental in higher education, take on a new dimension in the digital environment. Skliarova et al., (2022) argues that students experienced improvements in flexibility, convenience and productivity in their studies due to the online learning modality.

Finally, the role of the teacher remains essential, even in a technology-dominated environment. While digital tools offer opportunities for personalization and adaptability of learning, the educator's guidance and expertise is irreplaceable.

General Objective:

To analyze the evolution and trends of research in the Heuristic Method, research skills and teaching practice in higher education, through a bibliometric analysis based on the Scopus database from 2013 to 2023.

Specific Objectives:

To identify the number and types of publications related to the Heuristic Method, research skills and teaching practice in higher education during the study period.

Examine the relevance and impact of research in these areas, determining the most cited and their influence in the academic field.

Describe the interaction and convergence between online and blended learning with the Heuristic Method, research skills and teaching practice.

Evaluate the adaptation and evolution of teaching practice according to the demands and opportunities presented by online and blended learning.

Identify emerging areas or gaps in the existing literature that require further attention and research in the future.

Methodology:

2.1 Obtaining Data from Scopus:

The basis for this study is information obtained from Elsevier's Scopus, a leading academic database, as of August 31, 2023. Scopus, with its broad focus, covers areas from the sciences to the humanities. The research focused on articles published between 2013 and 2023, in English and Spanish languages. Through specific criteria in Scopus, 4,071 documents were identified, of which 2,448 are articles that constitute the core of this bibliometric analysis (see Figure 1).

2.2 Scopus Search Protocol:

Search sequences were designed in Scopus to ensure the relevance and accuracy of the information collected. The main search sequence was:

(TITLE-ABS-KEY ("Heuristic Method" OR "Research Skills" OR "Hermeneutics" OR "Teaching practice" OR "formative research") AND ALL ("HIGHER EDUCATION" OR "VIRTUAL HIGHER EDUCATION" OR "HIGHER EDUCATION INSTITUTION" OR "UNIVERSITY" OR "UNIVERSITIES" OR "School" OR "High School" OR "Elementary School" OR "Middle School" OR "Junior High") AND ALL ("Online Learning" OR "E-learning" OR "blended" OR "Hybrid learning" OR "blended learning" OR "face-to-face learning" OR "in-person learning" OR "IN-PERSON CLASSES" OR "ON-SITE")) AND PUBYEAR > 2012 AND PUBYEAR < 2024 AND (LIMIT-TO (DOCTYPE , "ar"))

2.3 Data Processing and Cleaning:

Inspired by bibliometric analyses similar to the one conducted by Zhang et al. (2023) on influenza-related encephalopathy, from the initial collection of 2,448 articles, a filtering and validation process was carried out to ensure data integrity and reliability. Python and the tools bibtexparser and pandas were used to manage and debug the information.

Thanks to pybtex, it was possible to consolidate fields in the .bib file, facilitating subsequent analysis. At the conclusion of this step, 2,363 items were consolidated for analysis.

Following methodologies similar to those of Belolutskaya et al., (2023) from the initial collection of 2,448 articles, a filtering and validation process was carried out to ensure the integrity and reliability of the data. Python and the tools bibtexparser and pandas were used to manage and debug the information. Thanks to pybtex, it was possible to consolidate fields in the .bib file, facilitating subsequent analysis. At the conclusion of this step, 2,363 items were consolidated for analysis.

2.4 Bibliometric evaluation:

With the information already processed, to visualize the data Pandas matplotlib, vosviewer and biblioshiny (), the analysis with the bibliometrix library yielded 2,363 documents, 1,104 journals and 6,776 authors.

2.5 Linkage with the Heuristic Method:

The heuristic approach has gained relevance in multiple academic fields. Through bibliometric analysis, its influence and role in the academic context was explored, uncovering trends and patterns in the studies. This methodology provided an in-depth perspective on contemporary and emerging literature linked to the heuristic method.

Results:

The initial data analysis revealed that the proportion of articles in the total records in Scopus with 60.1% in the percentage of article, for Conference paper 28.7% and Book chapter 6.5%, respectively. Similarly, for Review 2.6% and Book 1.3% being these are the five main types of documents where our research is found. See Figure 1.

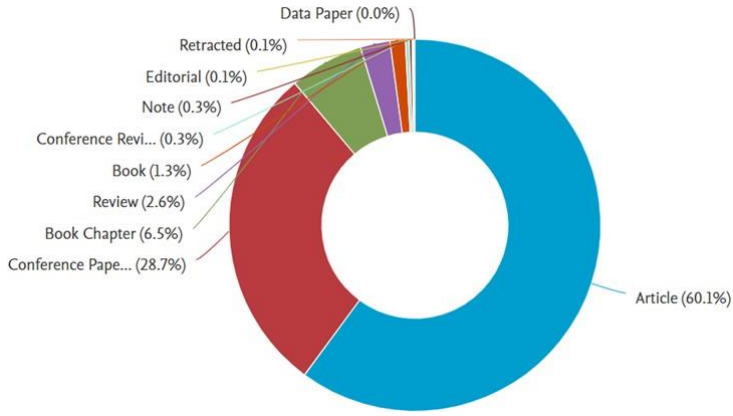

Figure 1: Type of document

Having a greater number of records in article of 2488 of the total 4071 types of documents, it was decided to make a cautious and rigorous analysis in this type of document where with the help of Python to debug and give as a final result 2363 articles to be analyzed and also realize the area where the publications are focused.

Figure 2 illustrates the distribution of these articles according to different areas of knowledge. It is notable that Social Sciences tops the list with 1,693 articles, representing 39.9% of the total. This is followed by Computer Science with 754 articles (17.7%) and Engineering with 391 articles (9.2%). The remaining areas, although less represented, also show a significant presence of the heuristic method in their research.

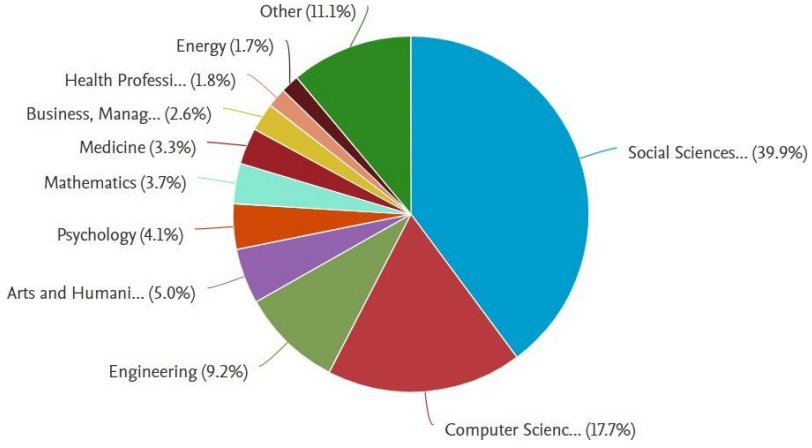

Figure 2: Thematic area

The predominance of the Social Sciences in the application of the heuristic method is not

accidental. These disciplines, by their nature, deal with complex human and social phenomena that are not always suited to traditional research methods. The heuristic method, with its ability to provide practical and experiential solutions, presents itself as an invaluable tool for social science researchers. This tool not only allows them to address the inherent complexity of their object of study, but also reflects the adaptability and versatility of the social sciences in their constant quest to understand human and social nature.

3.1 Publication trend by year

The year-based analysis of publication trends revealed that the number of papers published in Scopus had gradually increased over time, from 83 papers in 2013 to 360 of what of the year 2023 which data was extracted up to August 31 of the total 2363 articles see Figure 3.

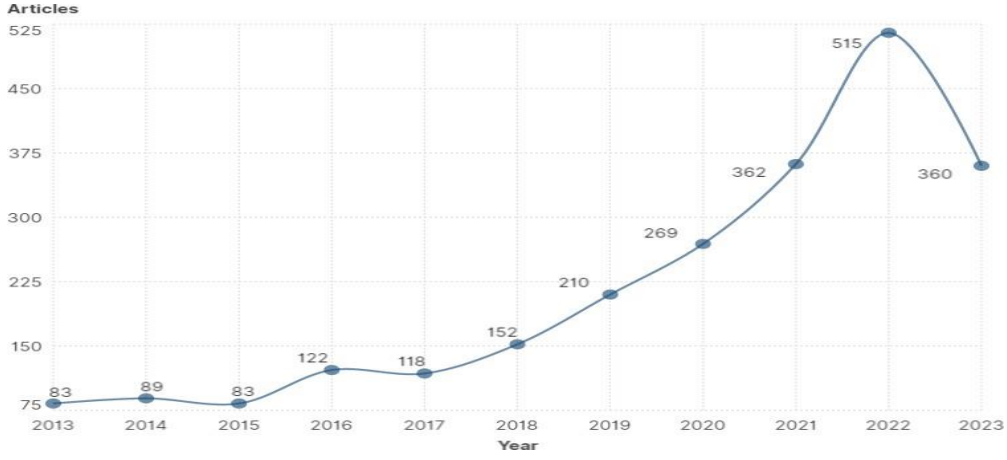

Figure 3: Publication trend

The analysis of the 10 years shows that the year 2022 is the highest in terms of the number of publications with a total of 512 articles, giving a median of 152, which indicates that 50% of the publications per year are below this number and a mean of 214.82, which means that this number of articles are published per year.

3.2 Trend of authors who have published on the research.

The result that bibliometrix yielded is 6,776 authors out of the total of 2363 articles, giving a mean of 1.3% who have published in the periods we have selected and a median of 1, this indicates that we have more than each author with at least one article publication with 50%, the minimum value is 1 and the maximum value is 15, see Figure 4.

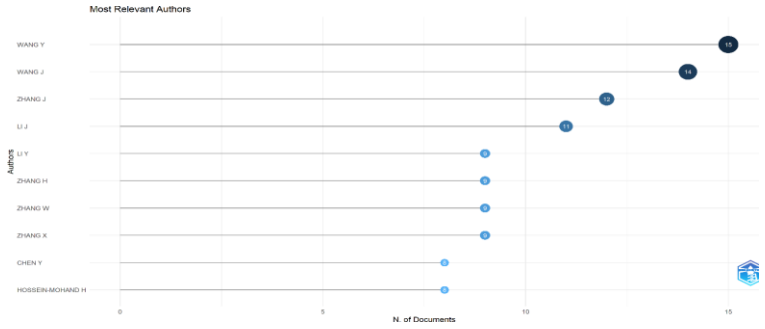

Figure 4: Most relevant authors

With an average of 1.13 per author publications, having the author Wangy Yuanhua with 15 articles, Wang Jianlan 14 articles, Zhang Jing 12 articles, within the field of topological optimization, the work of Wang Yizhou (Deng et al., 2022) stands out for its pioneering approach. In "Self-directed online machine learning for topology optimization", the author introduces a methodology that fuses deep neural networks (DNN) with the Finite Element Method (FEM). Unlike other studies, Wang contrasts the effectiveness of "Self-directed online machine learning optimization" with traditional heuristic methods. Through his research, it is shown that this optimization is not only more efficient, but also drastically minimizes computational times. This innovative approach has led the article to be highly cited, with 26 citations, making it a key piece in the bibliometric study on the subject.

3.3 Trend of authors who have published on the research.

By analyzing the "Authors' Production over Time" option in bibliometrix, the evolution of the academic production of various authors over the years is highlighted. This tool is crucial to identify trends and the contribution of authors in a specific field of study the 10 authors see figure 5.

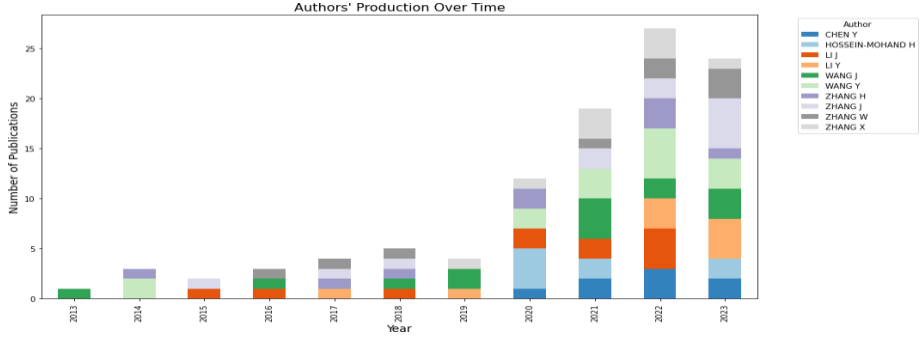

Figure 5: Authors' production over time

First, WANG Y has maintained a steady output since 2014, and surprisingly, in 2022, he published 5 articles, this being his most prolific year. Despite this, it was in 2020 when it reached

a peak in the number of citations, with a total of 36.

On the other hand, WANG J has shown a varied production since 2013. However, it is in 2021 where he stands out notably, as his 4 publications that year accumulated 67 citations.

Likewise, ZHANG J started its trajectory in 2015 and has maintained a constant presence in academia. It is important to highlight that in 2021 and 2023, he experienced a significant increase in both publications and citations.

Similarly, LI J has been active since 2015, but it was in 2022 that it achieved considerable impact, with 47 citations spread over 4 publications.

For its part, LI Y had an outstanding year in 2017, where, despite having only one publication, it received 126 citations, demonstrating its relevance in the field.

As for ZHANG H, although he has had a scattered production since 2014, that same year he achieved a high number of citations, with a total of 63.

Meanwhile, ZHANG W has shown increasing production since 2016, with a notable increase in the number of publications in 2023.

Additionally, ZHANG X made a significant impact in 2019 with 58 citations for its only publication that year, and since then, it has maintained a regular output.

Finally, CHEN Y and HOSSEIN-MOHAND H have shown a notable presence in recent years, with peak citations in 2021 for both authors.

3.4 Trend Local impact of authors h index vs total citations.

Figure 6 below presents a visual analysis of the output and impact of a select group of academic authors. The image highlights key metrics that describe the influence and visibility of these authors in the research world. Each point on the graph represents a specific author and is marked with a unique color for easy identification. The x and y axes represent the h-index and total number of citations (TC) respectively, two crucial indicators of an author's importance in his or her field. As we explore this graphical representation, we can gain a visual understanding of how these authors stand out in terms of their scholarly impact.

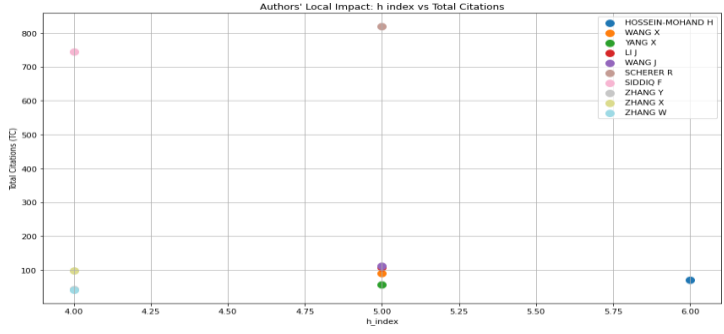

Figure 6: Local impact of authors

In the analysis of the academic output of the selected authors, the diversity of their impact metrics and the breadth of their research contribution stand out. The author with the highest h-index is HOSSEIN-MOHAND H, with a value of 6, indicating that he has published at least 6 papers that have been cited at least 6 times each. In addition, he has a g-index of 8 and an m-index of 1,500, suggesting a strong influence in his field of study. In terms of total number of citations (TC), HOSSEIN-MOHAND H has accumulated 70 citations in total. In contrast, LI J has an h-index of 5 and a g-index of 10, indicating a high concentration of citations in a limited number of publications. In addition, his m- index is 0.556, suggesting a more even distribution of citations in his work. LI J has an impressive CT of 109, indicating a broad influence in his research area. These are just a few examples of prominent authors and their impact on the academic community.

3.5 Trend of topics authors who have published on the research.

As bibliometrix had a flaw where it did not count keywords equally and gave a broader and more detailed view, the author_keywords and keywords columns were merged. This combination provided them with comprehensive access to all keywords, allowing them to carry out an exhaustive analysis, significantly enriching the research. The findings of this analysis are shown in Table 1.

Table 1. Most frequent words

Words	Occurrences
teaching	289
heuristic methods	282
e-learning	252
higher education	204
education	196
students	195
teaching practices	152
learning	150
online learning	120
optimization	107

In order to visualize the key themes identified in the bibliometric analysis in a clearer and more structured way, the VOSviewer tool was used. This tool made it possible to create a network graph showing the interconnections between the various keywords and their frequency of occurrence. The resulting figure, which can be seen below, highlights the relationships and prominence of certain terms in the data set analyzed as shown in Figure 7.

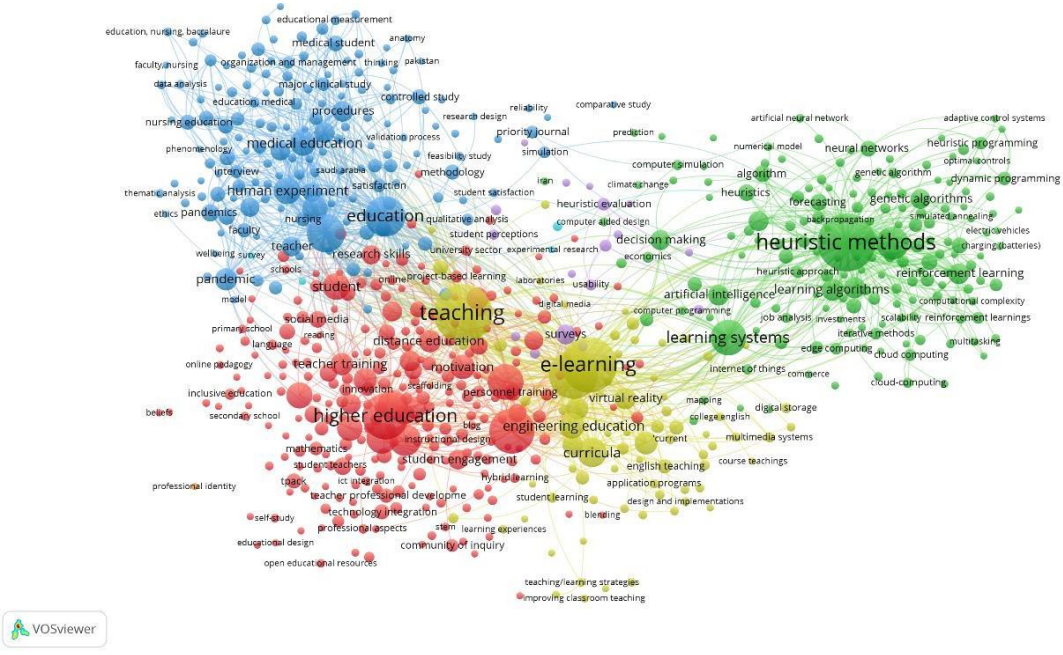

Figure 7: Co-occurrence network Dominant in the Current Academic Landscape

Based on an exhaustive bibliometric analysis of various articles, we have identified essential themes that predominate in contemporary academia. Of a significant set of keywords, some stand out for their frequency of occurrence. For example, "teaching" is mentioned 289 times, highlighting its importance in the field of study. On the other hand, "heuristic methods" appears 282 times, evidencing its relevance, although it is only one part of a larger set of topics. The term "e-learning", with 252 mentions, reflects the growing trend towards digital education. Likewise, words such as "higher education" (204 times), "education" (196 times) and "students" (195 times) underscore the focus on higher education and the central role of the student. Other terms such as "teaching practices", "learning", "online learning" and "optimization" also recur, suggesting an interaction between conventional education and emerging methodologies.

3.6 Evolution of the themes of the themes of the authors who have published on the research.

Within the vast spectrum of academic research, visual representation of data plays a crucial role in providing a clear and concise perspective on emerging trends and patterns. Before diving into the specific details of the thematic developments surrounding the heuristic method, it is essential to have an overview that allows us to contextualize the subsequent findings. Below, Figure 8 provides a graphical representation that captures the essence of these changes over time, setting the stage for further discussion.

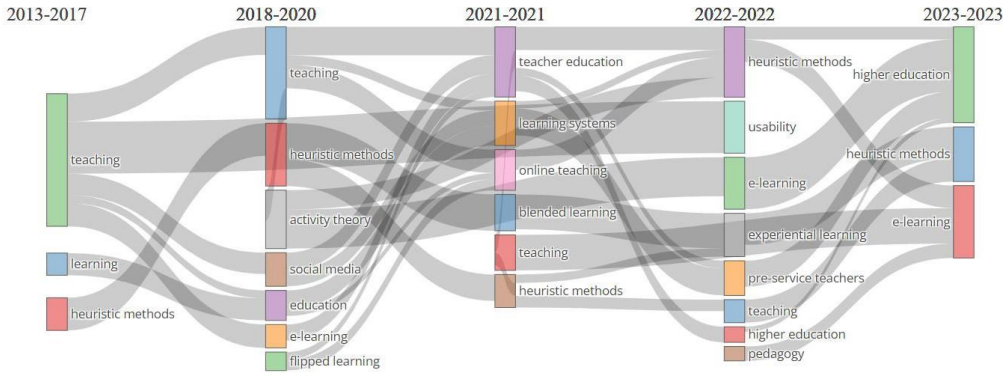

Figure 8: Thematic evaluation

Over the last decade, research around the heuristic method has undergone remarkable transformations. In the early years, specifically between 2013-2017 and 2018-2020, the dominant topics were oriented towards optimization, exploration of genetic algorithms, and deepening heuristic programming. However, as we move towards 2021-2023, there is a perceived shift towards more innovative areas, such as deep learning, reinforced learning and edge computing applications.

Over the last decade, the study of heuristic methods has undergone significant evolutions. During the years 2013-2017 and 2018-2020, research focused mainly on optimization, genetic algorithms and heuristic programming. However, in the period 2021-2023, a transition is observed towards more cutting-edge areas, such as deep learning, reinforced learning and edge computing applications.

In parallel, the field of pedagogy and learning has maintained its relevance in academic discourse. Terms such as "e-learning", "teaching practices" and "curriculum" have emerged regularly, reflecting a trend towards educational digitalization and technological integration in teaching. From the student perspective, there has been a shift in topics of interest. While 2018-2020 highlighted educational technology and sustainable development, 2021-2023 have evidenced a growing interest in e-learning modalities and innovative pedagogical methodologies.

A disruptive factor in the academic literature has been the emergence of the term "COVID-19" during 2021-2022, demonstrating the impact of the pandemic on educational practices and priority research areas. In addition, the renewed interest in "heuristic evaluation" in 2021-2023 indicates a reconsideration of this method in current contexts.

It is crucial to highlight the thematic connections that have emerged. The interrelationship between "students" and "e-learning" has been persistent, showing the interaction between the student experience and trends in digital learning.

3.7 Thematic map on the research.

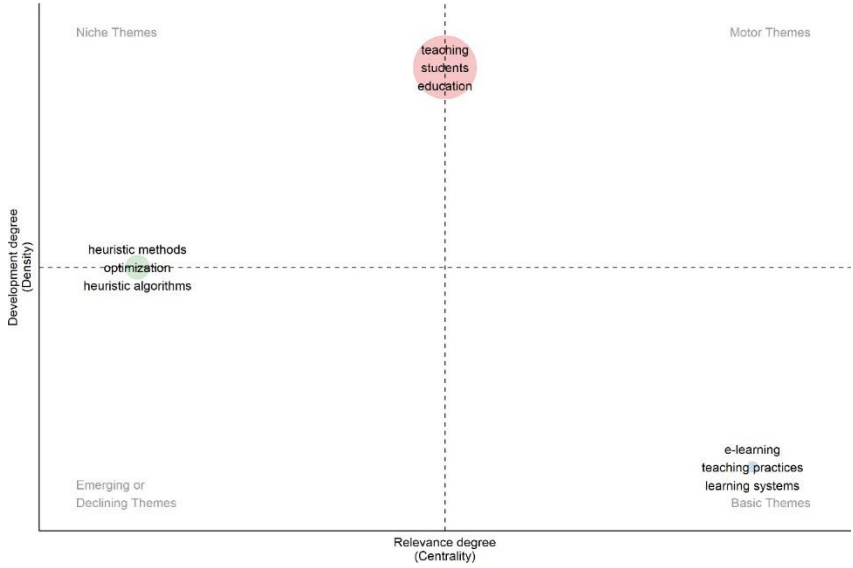

Figure 9: Thematic map

In Figure 9, they are mainly identified with the labels: "teaching", "students" and "education", the "teaching" cluster emerges with a frequency of 265, evidencing its central position in higher education research. Its betweenness centrality is 86.1038, and its closeness centrality is 0.0019685, underlining its relevance in the dataset. In addition, its centrality pagerank is 0.0403806, which reinforces its importance. Within this cluster, terms such as "learning", "curriculum", "human experiment" and "medical education" are of special interest.

Other relevant terms within the "teaching" cluster include "student" with a frequency of 54, "higher education" with 28, and "motivation" with 24. The presence of terms such as "pandemic" and "coronavirus disease 2019" suggests the influence of recent events in educational research in the context of higher education.

These clusters and associated terms provide a detailed overview of the research areas being prioritized in the field of higher education, especially in the context of online and blended learning, providing valuable insight into current trends in the field.

3.8 Recording of sources of total documents

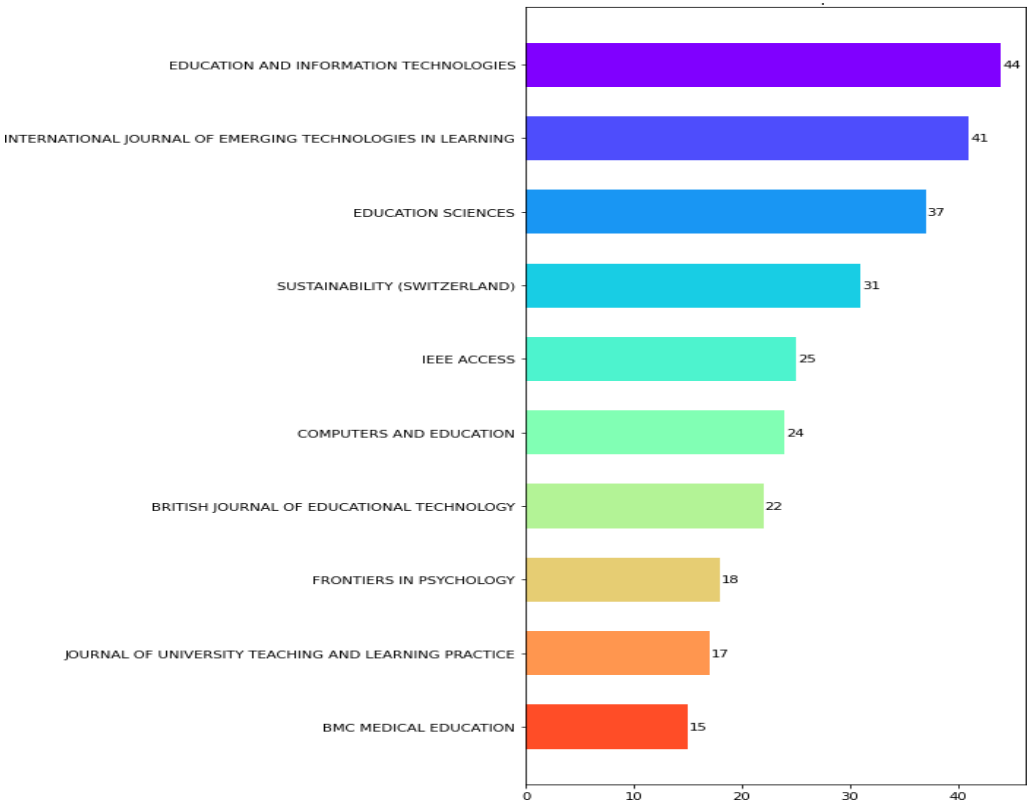

Figure 10: Most relevant sources

Figure 10 highlights the most influential academic sources in the field of study, ranked according to the number of articles published. "EDUCATION AND INFORMATION TECHNOLOGIES" tops the list with 44 articles, followed closely by "INTERNATIONAL JOURNAL OF EMERGING TECHNOLOGIES IN LEARNING" with 41 publications. "EDUCATION SCIENCES" and "SUSTAINABILITY (SWITZERLAND)" have also made significant contributions with 37 and 31 articles, respectively. It is notable that recognized sources such as "IEEE ACCESS" and "COMPUTERS AND EDUCATION" have contributed 25 and 24 articles, respectively. Other relevant sources, such as "BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY" and "FRONTIERS IN PSYCHOLOGY", reinforce the diversity and richness of contributions in this area. Overall, Figure 10 offers a panoramic view of the sources that have been pillars in the generation of knowledge in the area of interest.

3.9 Recording of sources of document citations

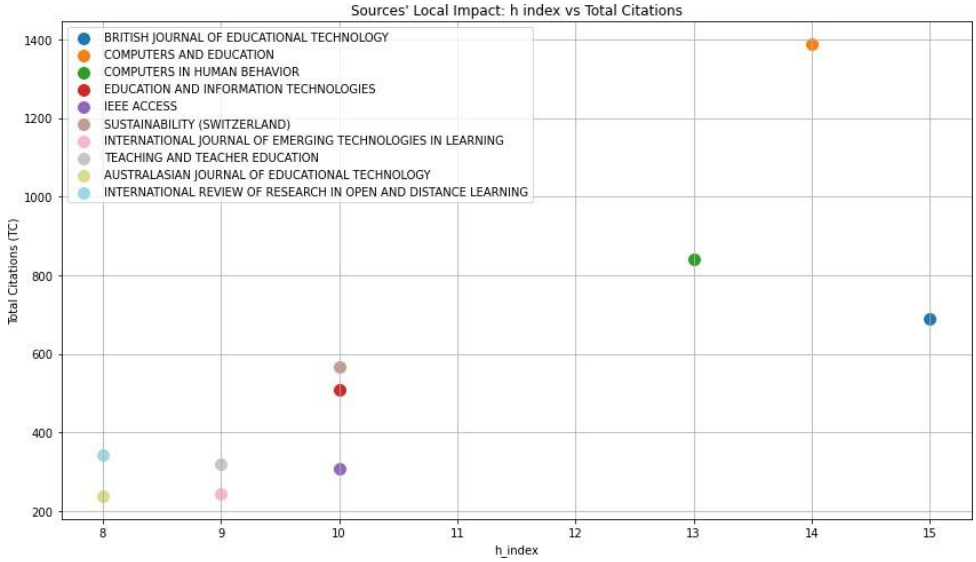

Figure 11: Sources' Local Impact: h index vs Total Citations

Figure 11 represents the impact of various academic publications, comparing their h-index with the total accumulated citations. It is notable how "COMPUTERS AND EDUCATION", with an h-index of 14, tops the list in terms of total citations with 1,388. Although "BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY" boasts a slightly higher h-index, its citation count is lower. Publications such as "COMPUTERS IN HUMAN

BEHAVIOR" and "IEEE ACCESS" demonstrate a balanced relationship between their h- index and citation count. Meanwhile, "EDUCATION AND INFORMATION TECHNOLOGIES", with 44 articles since 2013, reflects a prolific contribution in volume of publications. Other sources, such as "SUSTAINABILITY (SWITZERLAND)" and "INTERNATIONAL JOURNAL OF EMERGING TECHNOLOGIES IN LEARNING",

have also left a significant footprint in the field. Overall, this figure highlights publications that have had a notable impact on the research field.

3.10 Record of source production over time

As we move into the digital age, the landscape of higher education research has undergone remarkable changes. Figure 12 illustrates this dynamism, presenting the publication trajectory of five prominent journals from 2013 to 2023.

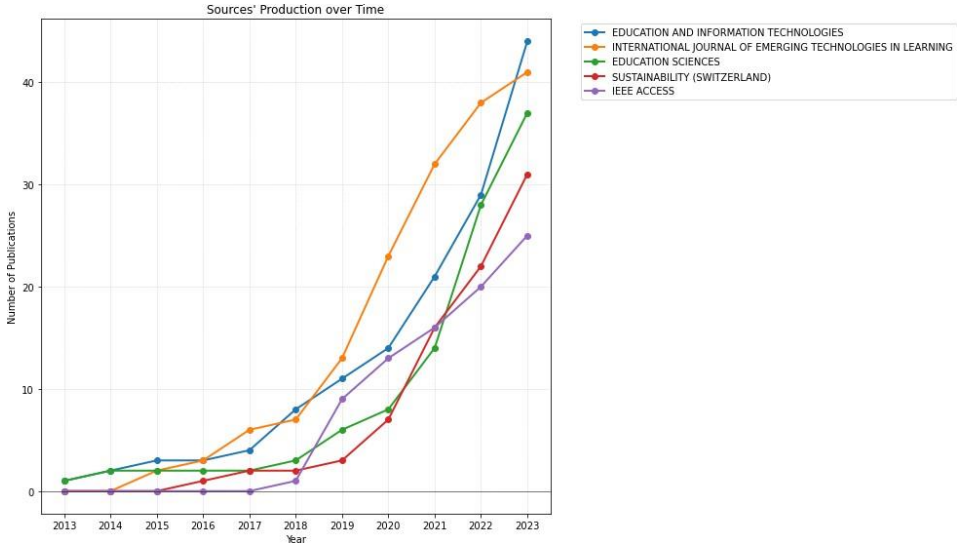

Figure 12: Sources' Production over Time

This graph highlights an upward trend in the production of research focused on heuristic method, research skills and teaching practice. The journals, with their growth year after year, demonstrate a renewed commitment to these topics, underscoring their relevance in the contemporary educational environment.

Figure 12 not only serves as a barometer of academic interest in these topics, but also highlights the significant contribution of these journals in the promotion and dissemination of knowledge. The evolution captured in this figure invites the academic community to continue exploring and contributing to this field, recognizing its impact on teacher training and practice in higher education.

Discussion:

The bibliometric analysis presented in this study provides a detailed overview of current trends in educational research, focusing on the Heuristic Method, Research Skills and Teaching Practice in the context of Higher Education. The figures and percentages reveal a predominance of Social Sciences, indicating a social and humanistic approach in research on these topics.

The predominance of 60.1% of articles in Scopus underlines the relevance of academic studies in article format in the research field. These articles, with their methodological rigor and peer review, are essential sources of information and knowledge in education.

A study by Zaharias & Koutsabasis (2012) highlights the importance of E-learning platforms as Knowledge Management applications, facilitating knowledge construction and sharing. In line with our study, this paper also emphasizes the relevance of tools and modules that facilitate

knowledge construction and sharing among participants.

On the other hand, the published research of H. Turhangil Erenlergil Erenler (2018). examines the usability of the Moodle learning management system in a computer literacy course in Turkey. This study reinforces the idea that learning management systems are crucial tools for blended and online learning, aligning with our focus on Online and Blended Learning.

In addition, an article by Zardari et al. (2021) highlights the development of an e-learning portal for university students based on adaptive web design. This study complements our analysis by focusing on the importance of usability and user experience in e-learning platforms.

Conclusion

The educational landscape of higher education has undergone significant transformations in the last decade, largely driven by the adoption and evolution of modalities such as online and blended learning. Through the bibliometric analysis conducted, the growing relevance of the Heuristic Method, research skills and adaptability in teaching practice within this new educational paradigm has been evidenced.

The Heuristic Method emerges not only as a pedagogical tool, but also as an essential competence for students in the digital environment, enabling them to navigate effectively in a sea of information. Similarly, research skills take on a critical dimension in a world where access to information is broad, but the ability to discern its validity is essential.

The role of the teacher, far from being obsolete, is reaffirmed as fundamental. Despite technology and digital tools, the experience, guidance and adaptability of the educator are irreplaceable, requiring constant training and updating to respond to the demands of the 21st century.

This study, by providing an overview of research in these critical areas, not only sheds light on current trends and developments, but also identifies emerging areas that require further attention and exploration. It is hoped that the findings presented will serve as a basis for future research, and as a guide for educators, researchers, and decision makers in higher education.

WORKS CITED

Abdullah, S., & Shariff, A. (2008). The effects of inquiry-based computer simulation with cooperative learning on scientific thinking and conceptual understanding of gas laws. Eurasia Journal of Mathematics, Science and Technology Education, 4(4), 387-398. Scopus. https://doi.org/10.12973/ejmste/75365

Altowairiki, N. F. (2023). Universal Design for Learning Infusion in Online Higher Education. Online Learning Journal, 27(1), 296-312. Scopus. https://doi.org/10.24059/olj.v27i1.3080

Antón-Sancho, Á., Fernández-Arias, P., & Vergara, D. (2023). Perception of the Use of Virtual Reality Didactic Tools among Faculty in Mexico. Future Internet, 15(2). Scopus. https://doi.org/10.3390/fi15020072

Belolutskaya, A., Vachkova, S., & Patarakin, E. (2023). The Connection of the Digital Learning Component with the Development of Preschool and School-age Children: A Review of Research and International

Educational Practices. Education and Self Development, 18(2), 37-55. Scopus. https://doi.org/10.26907/esd.18.2.04

Deaconu, O., Deaconu, A. M., Chitonu, G. C., & Taus, D. (2022). The Online Teaching System as a Sustainable Way of Learning. Sustainability (Switzerland), 14(18). Scopus. https://doi.org/10.3390/su141811556

Deng, C., Wang, Y., Qin, C., Fu, Y., & Lu, W. (2022). Self-directed online machine learning for topology optimization. Nature Communications, 13(1), Article 1. https://doi.org/10.1038/s41467-021-27713-7

Eryilmaz, A. (2015). Positive Psychology in the Class: The Effectiveness of a Teaching Method Based on Subjective Well-Being and Engagement Increasing Activities. International Journal of Instruction, 8(2), 17-32. https://doi.org/10.12973/iji.2015.822a

Gray, C. M., McKilligan, S., Daly, S. R., Seifert, C. M., & Gonzalez, R. (2019). Using creative exhaustion to foster idea generation. International Journal of Technology and Design Education, 29(1), 177-195. Scopus. https://doi.org/10.1007/s10798-017-9435-y

Guclu, S. (2016). An experimental study towards young adults: Communication skills education. Egitim Arastirmalari - Eurasian Journal of Educational Research, 63, 279-292. Scopus. https://doi.org/10.14689/ejer.2016.63.16

H. Turhangil Erenlergil Erenler, H. (2018). Heuristic Evaluation of E-Learning. International Journal of Organizational Leadership, 7(2), 195-210. https://doi.org/10.33844/ijol.2018.60235

Hernández-Gómez, J. C., Locia-Espinoza, E., Morales-Carballo, A., & Sigarreta-Almira, J. M. (2019). The counterexample in the elaboration of the definition of the convex function for university students. Informacion Tecnologica, 30(1), 185-202. Scopus. https://doi.org/10.4067/S0718-07642019000100185

Kaur, M., Mehta, H., Randhawa, S., Sharma, P. K., & Park, J. H. (2021). Ensemble learning-based prediction of contentment score using social multimedia in education. Multimedia Tools and Applications, 80(26-27), 34423-34440. Scopus. https://doi.org/10.1007/s11042-021-10806-2

Lima, I. B., & Hwang, W. (2023). Effects of Heuristic Type, User Interaction Level, and Evaluator's Characteristics on Usability Metrics of Augmented Reality (AR) User Interfaces. International Journal of Human-Computer Interaction. Scopus. https://doi.org/10.1080/10447318.2022.2163769

Mohammed Hassan Al-Ahdal, A. A., Alqasham, F. H., & Mohammed Qarabesh, M. A. (2022). Lateral Multimodal Learning in a Saudi EFL Context: Investigating the Perceptions of Teachers and M2E Female Learners. F1000Research, 11. Scopus. https://doi.org/10.12688/f1000research.109454.1

Molefe, L. L., & Mabunda, N. F. (2022). Online teaching and learning: Experiences of students in a nursing college during the onset of COVID-19. Curationis, 45(1). Scopus. https://doi.org/10.4102/curationis.v45i1.2372

Saleh, A. Y., Chin, G. S., Othman, M. K., Mohamad, F. S., & Chen, C. J. (2023). Immersive Visualization of Python Coding Using Virtual Reality. International Journal on Advanced Science, Engineering and Information Technology, 13(1), 336-347. Scopus. https://doi.org/10.18517/ijaseit.13.1.16028

Skliarova, I., Meireles, I., Martins, N., Tchemisova, T., & Cação, I. (2022). Enriching Traditional Higher STEM Education with Online Teaching and Learning Practices: Students' Perspective. Education Sciences, 12(11). Scopus. https://doi.org/10.3390/educsci12110806

Zaharias, P., & Koutsabasis, P. (2012). Heuristic evaluation of e-learning courses: A comparative analysis of two e-learning heuristic sets. Campus-Wide Information Systems, 29(1), 45-60. https://doi.org/10.1108/10650741211192046

Zardari, B. A., Hussain, Z., Arain, A. A., Rizvi, W. H., & Vighio, M. S. (2021). QUEST e-learning portal: Applying heuristic evaluation, usability testing and eye tracking. Universal Access in the Information Society, 20(3), 531-543. Scopus. https://doi.org/10.1007/s10209-020-00774-z

Zhang, Z., Tan, J., Li, Y., Zhou, X., Niu, J., Chen, J., Sheng, H., Wu, X., & Yuan, Y. (2023). Bibliometric analysis of publication trends and topics of influenza-related encephalopathy from 2000 to 2022. Immunity, Inflammation and Disease, 11(9). Scopus. https://doi.org/10.1002/iid3.1013

Zhao, Y., Gomez, M. C. S., Pinto Llorente, A. M., & Zhao, L. (2021). Digital Competence in Higher Education: Students' Perception and Personal Factors. Sustainability, 13(21), 12184. https://doi.org/10.3390/su132112184

Zhou, Y. (2023). Research on the construction and sustainable development of online teaching model for universities based on deep learning. Applied Mathematics and Nonlinear Sciences. Scopus. https://doi.org/10.2478/amns.2023.2.00142