Analysis of the Subareas of Education in Universities of a Developing Country: from a Multivariate Perspective

Author 1:

Carolina Daysi Villacís-Macías, ORCID: https://orcid.org/0000-0001-7376-099X,

E-mail: cvillacism@unemi.edu.ec, Universidad Estatal De Milagro, Ecuador

Author 2:

Kenia Layli Laz-Figueroa, ORCID: https://orcid.org/0009-0009-4754-9969,

E-mail: klaz@utb.edu.ec, Universidad Técnica de Babahoyo, Ecuador

Author 3:

Carina Rey-Martin, ORCID: https://orcid.org/0000-0002-5238-7353,

E-mail: carina.rey@ub.edu.es, Universidad de Barcelona, España

Author 4:

Dennis Alfredo Peralta-Gamboa, ORCID: https://orcid.org/ 0009-0009-0636-0094,

E-mail: dperaltag2@unemi.edu.ec, Universidad Estatal De Milagro, Ecuador

Abstract

This study focuses on an analysis of scientific production in the field of education within universities in developing countries. For this purpose, academic articles were classified into 17 predefined subareas: Higher Education, Educational Technology, Educational Policy, Inclusive Education, Pedagogy and Didactics, Science Education, and Mathematics. A keyword analysis algorithm was designed to identify and classify publications in these subareas using key terms present in the titles, abstracts, and authors' keywords.

This study used the multivariate HJ-Biplot technique to visualize the relationship between Ecuadorian universities and the research sub-areas in which they concentrated their scientific production. The results indicated that both public and private universities focus their research on key areas, such as Higher Education, Science and Mathematics Education, Educational Technology, and Inclusive Education, with significant differences in the correlations between subareas.

In particular, private universities show a strong correlation between Educational Technology and Health and Wellness Education, whereas the correlation between Inclusive Education and Science and Mathematics Education is weak. Additionally, low representation was identified in emerging sub-areas, such as Educational Policy and Neuroeducation, underscoring the need to foster more research in these areas.

Keywords: Higher Education; Educational Technology; Inclusive Education; Science and Mathematics Education; Health and Wellness Education.

Propuesta de Public Interest Statement

This study analyzes the scientific production of Ecuadorian universities in 17 subfields of education: higher education, educational technology, inclusive education, and science and mathematics education. Using advanced multivariate analysis, we identified the main research trends and areas in which universities are focusing their efforts. The findings revealed that most institutions prioritize higher education and science-related teaching methods, while fields such as educational policy and neuroeducation remain underexplored. These results are highly relevant for policymakers, educators, and society as they provide insights into the strengths and gaps in Ecuador's academic research. By understanding where efforts are concentrated, universities and funding agencies can better allocate resources, promote innovation, and improve educational quality. Ultimately, this study helps to connect academic research with national educational priorities, supporting more inclusive, technological, and evidence-based approaches to improve teaching and learning outcomes.

Introduction

Education is a fundamental pillar of the economic and social development of developing countries as it contributes to the reduction of poverty and social inequalities, which are key factors for the political stability and institutional development of a nation. (McGrath, 2010). Several studies have shown that investing in education, especially higher education, not only increases the productivity of the labor force, but also boosts knowledge creation, innovation, and sustainable economic growth.

For example, education has been shown to fosters human capital formation, which is essential for long-term economic growth. This is because more education increases individuals' ability to acquire new skills and adapt to technological changes, which, in turn, improves productivity and generates economic growth in key sectors (Hanushek & Woessmann, 2021).

Moreover, education generates positive externalities for society, such as the reduction of poverty and inequality as well as the strengthening of democratic institutions (Shi & Qamruzzaman, 2022). Research in emerging economies has shown that an educated population can improve social cohesion and promote political stability, which are crucial factors in social transformation and sustainable economic development (Ziberi et al., 2022).

However, the impact of education is not uniform across contexts and depends on factors such as the quality of the education system, equity in access, and type of education provided (Marquez-Ramos & Mourelle, 2019). In this sense, developing countries should prioritize not only the expansion of access to education, but also the improvement of its quality to maximize its contribution to growth and social transformation (Fomba et al., 2023).

Through educational research, universities can generate knowledge that addresses local and global challenges, thereby promoting sustainable and equitable progress (Price et al., 2021). In this context, analyzing the academic production of universities is essential to understanding the subareas of education that are receiving greater research attention.

This study focuses on analyzing the sub-areas of education in which the scientific production of universities in a developing country is concentrated. This type of analysis

makes it possible to assess the impact and relevance of the research conducted, providing a comprehensive view of current trends in higher education and the challenges facing the education sector. In particular, assessing the impact of research in higher education enables governments and educational institutions to make strategic adjustments to meet the challenges that arise in a globalized educational environment (Brika et al., 2022).

It seeks to identify patterns and relationships among educational research subareas as well as among higher education institutions using a multivariate methodology (Tessler, 2023). Multivariate analysis techniques, such as biplots, provide a graphical and quantitative representation of a matrix of data (Sanchez-Gonzalez, 1995) regarding how universities distribute their scientific production among various subareas. This allows for a detailed characterization of the priority areas for educational research in the country and suggests possible emerging areas that deserve further attention.

Research Questions

This study seeks to answer the following key questions related to educational research in Ecuadorian universities:

- What are the subfields of education in which Ecuadorian universities–both public and private–concentrate most of their academic production?
- How are educational research efforts distributed among the different Ecuadorian universities, and which subareas receive the most attention in each institution?
- What patterns of correlation exist between the different subareas of education investigated at Ecuadorian universities?
- Which emerging subareas in education are underrepresented in the scientific production of Ecuadorian universities and how can their development be encouraged?

This study aims to provide a comprehensive analysis of the educational research subareas in Ecuadorian universities, identifying not only the most productive fields, but also underrepresented and emerging domains. Understanding the current distribution of research efforts allows universities, policymakers, and funding institutions to detect opportunities for strategic investment, foster collaboration, and strengthen the country's educational research agenda. While this study does not seek to change institutional preferences, it does reveal where attention has been concentrated and where it is lacking, helping guide decisions toward more balanced and contextually relevant educational development.

The use of multivariate analysis, particularly the HJ-Biplot technique, is justified by its ability to simultaneously represent relationships between universities (individuals) and educational subareas (variables) in a low-dimensional space with high explanatory power. Despite its earlier development, the HJ-Biplot remains a relevant and effective method for visualizing complex patterns and has been used in recent empirical studies in education and social sciences. Its graphical nature facilitates intuitive interpretation and identification of clusters, correlations, and outliers, which are essential for data-driven policy and academic management in developing contexts such as Ecuador.

Methodology

This study used a quantitative methodology based on the analysis of articles published in the field of education in Ecuador. A search was carried out in the Web of Science database using the equation **CU=(Ecuador) AND (SU=(Education Educational Research))** to obtaining 1951 documents. The main objective was to identify the subareas most studied in the publications of Ecuadorian universities using RStudio software with R programming language version 4.4.1.

Articles were classified into subareas using a list of 17 predefined categories, including "Higher Education", "Educational Technology", and "Inclusive Education. To classify publications in these subareas, an algorithm was designed to identify keywords in the title, abstract, and authors' keywords.

The categories included in the analysis cover educational areas, such as:

- **Higher education**: key terms such as "higher education", "universities", "higher education institutions", and "higher education", among others.
- **Educational Technology**: included terms such as "educational technology", "online learning", "digital education", "ICT", and similar.
- **Educational Policy**: covering concepts such as "educational policy", "curricular reform", "educational policies", and other related concepts.
- **Inclusive Education**: with keywords such as "diversity in the classroom", "special education", and "inclusion", among others.
- **Pedagogy and Didactics**: terms related to "teaching methods", "pedagogical strategies", and "teaching practices".
- **Science and Mathematics Education**: encompassing "STEM", "science education", "and technology education", among others.
- **Health and Wellness Education**: with words such as "health", "wellness", "health promotion", and "physical education".
- Other sub-areas include **Comparative and International Education**, **Educational Assessment and Measurement**, **Education for Sustainable Development (ESD)**, **Social Science and Humanities Education**, **Literacy Research**, **Vocational and Technical Education**, **Adult Education**, **Educational Research and Research Methods**, **Neuroeducation**, and **Global Citizenship Education**.

Subsequently, data were filtered to eliminate articles without affiliations. This resulted in 573 articles with affiliations to the 17 Ecuadorian universities. Using these data, an HJ-Biplot representation was performed to visualize the relationship between universities and the subareas of education in which they have been published.

In Ecuador, all public universities operate under a state-level governance model. Therefore, the classification used in this study refers exclusively to **state public universities**, as there is no federal university system in the country. This clarification helps contextualize comparisons with private institutions, which may follow different administrative or funding models.

HJ-Biplot

The analysis was carried out using the multivariate HJ-Biplot technique, proposed by Galindo Villardón (1986). This methodology allows for the simultaneous representation of variables and individuals, and offers a high-quality graphical representation. It is a valuable tool for visualizing and intuitively understanding the relationships between variables and individuals without the need for advanced statistical knowledge. According to Galindo Villardón, the interpretation is based on the distance between points, the length of the vectors, the angles between them, and the location of the points with respect to a vector. One of the main strengths of the HJ-Biplot is its ability to identify combinations of variables that explain groupings, thus providing information on the similarity between the analyzed units. Moreover, it can be applied to any type of data matrix.

In this study, the data matrix was organized so that the Ecuadorian universities were arranged in rows and the education subareas in columns. The HJ-Biplot allowed both universities and subareas to be graphically represented in the same plane. The similarity between individuals is inversely proportional to the Euclidean distance between them, and the angles between the subareas indicate covariation. Acute angles represent a positive correlation, obtuse angles negativelytive correlated, and the right angles are independent. A greater projection of a point on a vector indicates significant deviation from the mean in that subarea.

The Biplot plane was constructed using the principal components derived from the eigenvectors of the covariance matrix between subareas. The eigenvalues indicate the proportion of the information explained by each plane (explained variance). The angle of each sub-area with the first and second factorial axes represents its contribution to the variability captured by each dimension. The sum of both the contributions determines the quality of the representation in the factorial plane.

The HJ-Biplot representations were generated using the MultBiplot software developed by Vicente Villardón (2010). In the resulting graphs, the education subareas are represented as vectors and the universities are labeled with their corresponding acronyms (see Table 1).

Table 1 Ecuadorian Universities

University	Higher Education
Private	
Facultad Latinoamericana de Ciencias Sociales – Ecuador	FLACSO
Pontificia Universidad Católica del Ecuador	PUCE
Universidad Politécnica Salesiana	UPS
Universidad San Francisco de Quito	USFQ
Universidad Técnica Particular de Loja	UTPL

Universidad de Especialidades Espíritu Santo	UEES
Universidad de las Américas	UDLA
Public	
Escuela Politécnica Nacional	EPN
Escuela Superior Politécnica del Ejército	ESPE
Escuela Superior Politécnica del Litoral	ESPOL
Universidad Central del Ecuador	UCE
Universidad Estatal de Milagro	UNEMI
Universidad Laica Eloy Alfaro de Manabí	ULEAM
Universidad Técnica de Ambato	UTA
Universidad Técnica de Manabí	UTM
Universidad Estatal de Cuenca	U-CUENCA
Universidad del Azuay	U-AZUAY

Clustering techniques based on biplot coordinates were used to collect information on the variables as well as their possible interactions. Hierarchical grouping was performed using the squared Euclidean distance method, which joins the cases minimizes the differences within each group. Finally, three clusters were selected for the analysis of public and private universities.

Results

The analysis revealed that Ecuadorian universities concentrate their academic production mainly on five subareas of education: Higher Education (n=61), Science and Mathematics Education (n=59), Health and Wellness Education (n=34), Educational Technology (n=128), and Inclusive Education (n=25).

For each type of university (public and private), all higher education institutions listed in Table 1 that submitted data in the five research subareas were analyzed. The data were standardized using columns. The variance explained by the factorial axes for each university type is presented in Table 2.

The HJ-Biplot representation for public universities was performed using the first three axes, which capture 85.003% of the total information and are considered sufficient to adequately characterize these institutions in terms of research subareas. Similarly, the HJ-Biplot representation for private universities was carried out using two axes, which explains 92.062% of the total information and is also sufficient to effectively characterize private universities.

Table 2 ***Eigenvalue*** *and explained variance*

Public Universities

Axis	Eigenvalue	Expl. var.	Var. Cumulative
Axis 1	18.245	40.545	40.545
Axis 2	11.969	26.597	67.142
Axis 3	8.037	17.861	85.003
Private Universities			
Axis 1	24.356	81.185	81.185
Axis 2	3.263	10.877	92.062

Table 3 shows the contribution of the axes to the research subareas for each university type. In the case of public universities, axes 2 and 3 provide the most information for the Higher Education, Health Education, and Welfare subareas, so these axes are key to their interpretation. For the subarea of Science and Mathematics Education, both axes 1 and 2 contribute equally, while in Educational Technology and Inclusive Education, axis 1 provides the greatest contribution, making it fundamental for its analysis.

For private universities, axis 1 represents most of the information, so it is essential for the interpretation of the HJ-Biplot in this type of institution.

Table 3 Contribution of the axes to the subareas of education

Public Universities			
Variable	Axis 1	Axis 2	Axis 3
Higher Education	61	475	336
Science and Mathematics Education	334	361	1
Health and Wellness Education	57	385	495
Educational Technology	808	11	51
Inclusive Education	767	97	11
Private Universities			
Higher Education	825	26	
Science and Mathematics Education	593	387	
Health and Wellness Education	985	0	
Educational Technology	963	3	
Inclusive Education	693	128	

Public Universities

An analysis was conducted on ten 10 universities that submitted data in the five education subareas. Of the institutions evaluated, ULEAM was not well represented in any plane. Figures 1 and 2 show the factor plots corresponding to planes 1-2 and 1-3. In these plots, the research subareas, represented by vectors, revealed a direct relationship between Higher Education and Science and Mathematics Education, between Educational

Technology and Inclusive Education, and a connection between Higher Education and Health and Wellness Education.

UTM and U-Cuenca universities are characterized by their strong focus on Higher Education as well as on research related to Science and Mathematics Education. This suggests that institutions that prioritize higher education tend to integrate their research into areas related to science and mathematics, highlighting the relevance of these disciplines in academic training. On the other hand, UNEMI stands out for its focus on Health and Wellness Education, concentrating its research mainly in this field in contrast to other institutions that diversify their efforts between Higher Education and Science and Mathematics Education. This suggests that research on health and wellness remains a more specialized area, which has not yet consolidated its relationship with other subareas in the Ecuadorian educational field (Figure 1).

On the other hand, universities EPN, U-Azuay, UTA, and ESPOL are distant from the educational subareas represented in the graph, indicating that their research focus is less aligned with the key educational areas analyzed, suggesting a specialization in other areas of knowledge.

Figure 2 shows that both U-Cuenca and UTM also stand out in research related to Inclusive Education and Educational Technology, indicating a shared focus on improving teaching in the university environment. Additionally, UCE stands out for its production in the subareas of Health and Wellness Education and Higher Education, consolidating itself as a relevant institution in these fields of study.

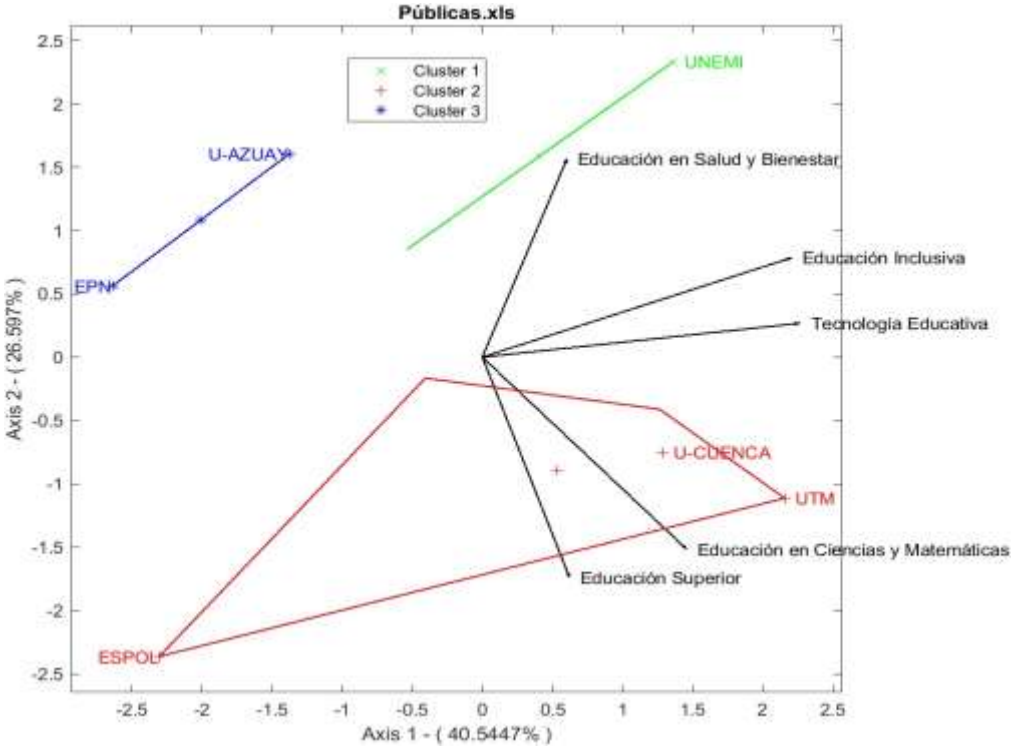

Figure 1 HJ-Biplot Public Universities, plan 1-2

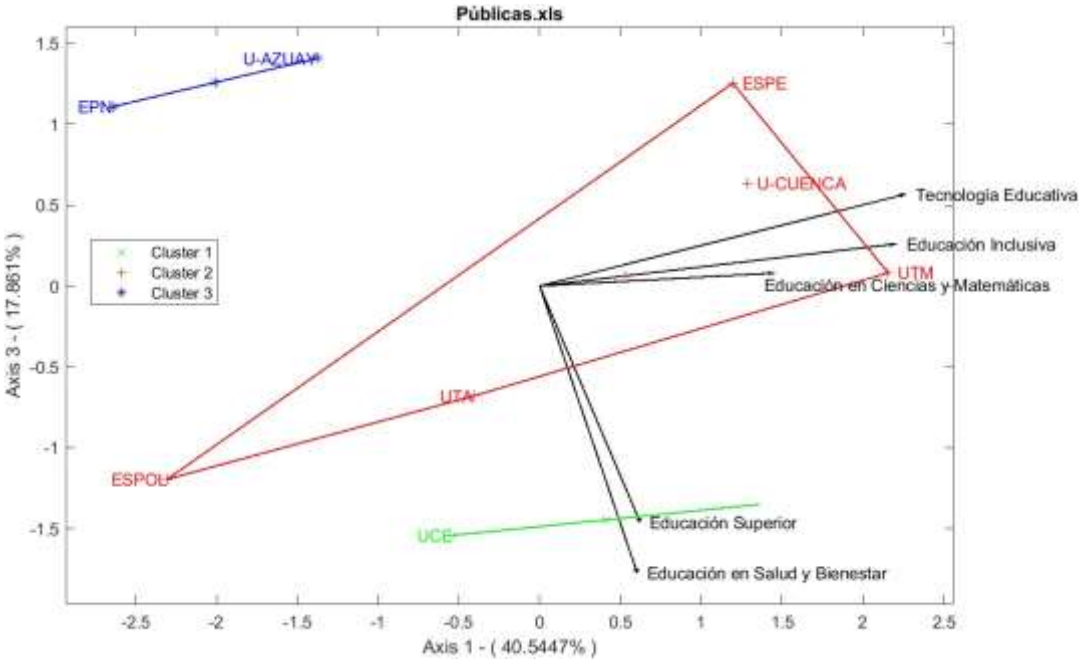

Figure 2 HJ-Biplot Public Universities, plane 1-3

Private Universities

The seven private universities are well represented in the 1-2 plane (Figure 3). Axis 1 plays a predominant role in all the studied education subareas, indicating that private universities concentrate a large part of their scientific production in these areas. A strong direct correlation between Educational Technology and Health and Wellness Education stands out, while the correlation between Inclusive Education and Science and Mathematics Education is weak.

The universities located on the left side of the graph (blue cluster) are not characterized by focusing their research on the subareas of education analyzed. In contrast, UTPL is well represented in the subarea of Inclusive Education, UPS stands out for its focus on

Higher Education, and PUCE stands out for its academic production in Science and Mathematics Education.

It is important to note that no private university is associated with the subareas of Educational Technology or Health Education and Wellness, indicating that these areas are not a major focus of their research.

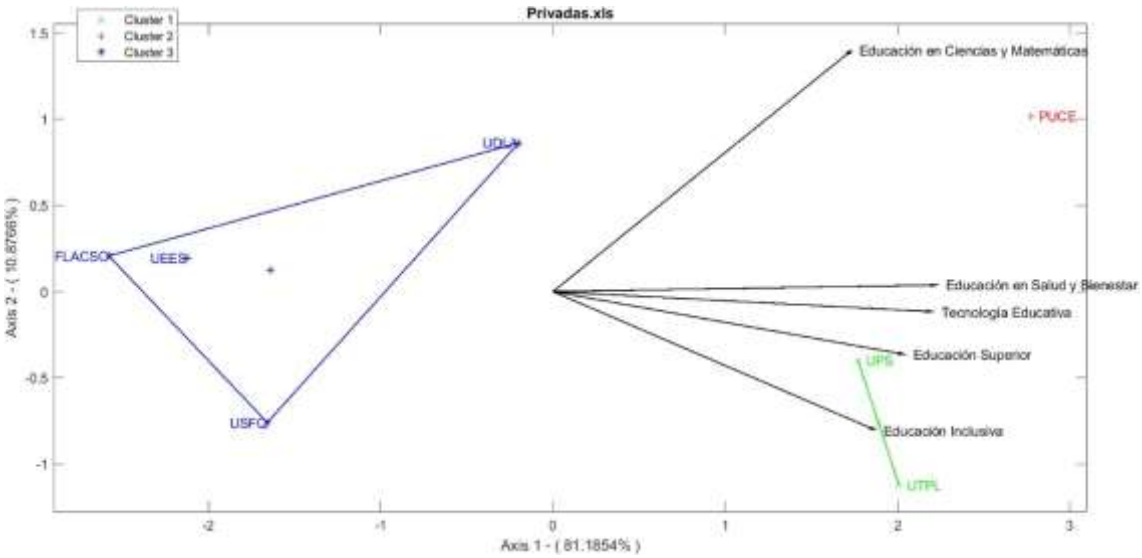

Figure 3 HJ-Biplot Private Universities, plan 1-2

Discussion

This research demonstrated the practical usefulness of the HJ-Biplot method for the classification of universities according to their research subareas. The HJ-Biplot technique (Galindo Villardón, 1986) allows a graphical representation to be made, in which university areas and subareas can be superimposed in the same reference system with maximum quality of representation.

The results of this study reveal that Ecuadorian universities, both public and private, tend to concentrate on certain subareas of education, reflecting their responses to the needs and circumstances of the country. In particular, universities have clearly focused on subareas such as Science and Mathematics Education, Higher Education, Educational Technology, Inclusive Education, and Health and Wellness Education. This focus seems to be related to the growing need to modernize teaching methods and integrate technology into the educational arena. It also aligns with the importance of improving the quality of science education in Ecuador. For example, Ocaña et al. (2023) found that the use of gamification in the design of emotional learning partner (ELP) programs for teaching programming to children in primary education improved students' learning scores, satisfaction, and motivation levels.

In the area of Inclusive Education, Mendoza Velazco et al. (2024) highlight that building resilience through inclusion has become a key pedagogical component in social work, strengthening this field. In contrast, UTM and U-Cuenca universities stand out for their focus on Higher Education and research in science and mathematics. In addition, both universities have significantly contributed to Inclusive Education and Educational Technology.

Cantos-López et al., (2020) authors from UTM, in their contribution to Higher Education, conclude that communication in the learning process should focus on essential aspects such as affectivity, empathy, self-esteem, listening and courtesy, which are crucial to highlight the individual and collective successes and difficulties of students. In addition, UTM has innovated in the field of Educational Technology, developing a software methodology called XPRUM, which combines processes of the Scrum and XP methodology with Kanban, which facilitates the management and visual control of projects.

Another outstanding contribution of UTM is project-based learning (PBL), which, according to Zambrano Briones et al. (2022), represents a valuable didactic alternative that increases interaction in the educational process. In addition, Pérez et al. (2021) demonstrated that the use of color texts in PowerPoint presentations on bioethics generated better grades and exam results than black and white presentations, due to the emotional, moral, and ethical load implied by these topics.

On the other hand, the U-CUENCA has shown, in studies such as those of Espinoza-Figueroa et al., (2021)that the research-based learning approach is more effective than traditional methods for linking theory with practice, by using case studies and real problems of the environment. Jiménez-Álvarez et al. (2021) also emphasized that a greater diversity of tools and strategies can improve academic performance in online education, although they warn that an excess of tools can overwhelm distance students, making it necessary to prioritize and plan activities appropriately.

Broos et al. (2020) stressed that the implementation of learning analytics (LA) in higher education must be supported by clear institutional policies. Although LA has great potential to improve performance, it still faces scalability and infrastructure challenges, which are the key factors for its success.

The State University of Milagro stands out in the subareas of Health Education and Wellness. A study conducted at the Buen Vivir Gerontological Center revealed that 44.3% of women with stage II hypertension consume between 1400-1600 kcal/day, showing that inadequate dietary intake and poor control of food preparation negatively influence hypertension and possible future complications (Moreno et al., 2023). Another study by UNEMI researchers during the pandemic found that respondents reported a greater impact on their work and economic environment, which generated concern and tension, although without losing optimism about a better future. The results of this study highlight the importance of supporting families in overcoming the anxiety present in some of their members. In this sense, it is essential to address mental health, as cases of anxiety and depression have increased considerably. Family psychologists play a crucial role in resolving these conflicts as well as in treating cases of substance abuse and domestic violence, problems that have been aggravated by confinement and prolonged cohabitation (Chévez et al., 2021).

UTPL stands out in the subarea of Inclusive Education, while UPS stands out for its focus on Higher Education and PUCE for its academic production in Science and Mathematics Education. PUCE researchers emphasize that Latin American governments, especially in Ecuador, must take measures to achieve true educational inclusion. Navarrete Mendieta

et al. (2020) suggested that technological tools play a crucial role in teaching-learning processes for people with disabilities, favoring inclusion.

On the other hand, Pinochet-Quiroz et al. (2022) presented evidence that points to the importance of including strategies in support plans for university students to improve their skills in cold executive functions (EF), given the negative impact of academic failure for both students and their families and the university system. In addition, Sevilla et al. (2019) highlighted that the joint use of technologies and cluster analysis in social networks allows more personalized management of students, ensuring quick response, effective communication, and access to reliable information that responds to their needs and expectations.

However, a low representation has been detected in emerging subareas such as Educational Policy and Neuroeducation, which highlights the need to promote more research in these areas. The lack of attention to these subareas may limit the impact of Ecuadorian universities on improving the educational system (Guerrero-Quiñonez et al., 2023). The relationship between advances in neuroscience and training processes is essential for improving the educational quality and future professional training. However, the fragmented and decontextualized management of higher education institutions limits their relevance to social, productive, and cultural contexts (Jiménez & Paredes, 2019). This underscores the importance of promoting new research to develop more comprehensive educational policies.

Recommendations for Fostering Research in Emerging Educational Subfields

To foster research in underrepresented subfields, such as Educational Policy and Neuroeducation, national funding bodies and academic institutions are recommended:

- Prioritize research calls and grant schemes that explicitly include these topics.
- Interdisciplinary research groups should be created that connect education with neuroscience and policy analysis.
- Encourage doctoral programs and postgraduate research to explore these areas.
- Promote international collaboration with institutions experienced in these fields
- These sub-areas are incorporated into strategic research agendas and accreditation criteria.

By creating favorable institutional and funding environments, it is possible to catalyze innovation and expand the academic impact of Ecuadorian universities in these critical yet underexplored domains.

Limitaciones

Although the inclusion of faculty size would enrich the comparative analysis, this study was limited by the lack of consistently available and updated data across all institutions. Future research should consider this variable to better contextualize research productivity.

Conclusions

This bibliometric study has allowed the identification of the key areas in which Ecuadorian universities concentrate their academic production in the field of education. In public universities, a strong focus was observed on Higher Education, Science and Mathematics Education, and Inclusive Education, while private universities show a stronger correlation between Educational Technology and Health and Wellness Education.

However, a lack of research in emerging areas such as Educational Policy and Neuroeducation was also identified, which presents an opportunity to expand the lines of research and have a broader impact on the quality of education in the country. This diversification of interests in Ecuadorian universities suggests that, although there is a solid research base in certain areas, there is still a way to go to fully integrate more specialized and emerging areas.

Finally, it is recommended that both public and private universities broaden their focus to less explored subareas, such as Educational Technology and Health and Wellness Education in the case of private institutions, which would contribute to strengthening the academic and social impact of their research in the Ecuadorian context.

References

Brika, S., Chergui, K., Algamdi, A., Musa, A., & Zouaghi, R. (2022). E-Learning Research Trends in Higher Education in Light of COVID-19: A Bibliometric Analysis. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.762819

Broos, T., Hilliger, I., Pérez-Sanagustín, M., Htun, N.-N., Millecamp, M., Pesántez-Cabrera, P., Solano-Quinde, L., Siguenza-Guzman, L., Zuñiga-Prieto, M., Verbert, K., & De Laet, T. (2020). Coordinating learning analytics policymaking and implementation at scale. *British Journal of Educational Technology*, *51*(4), 938-954. https://doi.org/10.1111/bjet.12934

Cantos-López, G. G., Mero-Quiroz, F. D., & Vinces-Mieles, V. A. (2020). La comunicación educativa en el aula: Una experiencia desde la práctica docente en el bachillerato. *Luz*, *19*(2), 102-112.

Chévez, E. Y. S., Asencio, V. J. R., & Ripalda, A. N. S. (2021). Aprendizajes del bienestar psicológico de las familias en confinamiento por Covid-19. *Revista Conrado*, *17*(S3), Article S3.

Espinoza-Figueroa, F., Vanneste, D., Alvarado-Vanegas, B., Farfán-Pacheco, K., & Rodriguez-Giron, S. (2021). Research-based learning (RBL): Added-value in tourism education. *Journal of Hospitality, Leisure, Sport & Tourism Education*, *28*, 100312. https://doi.org/10.1016/j.jhlste.2021.100312

Fomba, B. K., Talla, D. N. D. F., & Ningaye, P. (2023). Institutional Quality and Education Quality in Developing Countries: Effects and Transmission Channels. *Journal of the Knowledge Economy*, *14*(1), 86-115. https://doi.org/10.1007/s13132-021-00869-9

Galindo Villardón, P. (1986). Una alternativa de representación simultánea: HJ-Biplot. *Questiió: Quaderns d'Estadística, Sistemes, Informatica i Investigació Operativa*, *10*(1), 13-23.

Guerrero-Quiñonez, A. J., Guagua, O. Q., & Barrera-Proaño, R. G. (2023). A look at university education in Ecuador: Politics, quality and teaching. *Ibero-American Journal of Education & Society Research*. https://doi.org/10.56183/iberoeds.v3i1.623

Hanushek, E. A., & Woessmann, L. (2021). Education and Economic Growth. En E. A. Hanushek & L. Woessmann, *Oxford Research Encyclopedia of Economics and Finance*. Oxford University Press. https://doi.org/10.1093/acrefore/9780190625979.013.651

Jiménez, V. H., & Paredes, S. (2019). *EL HORIZONTE ESPISTEMOLÓGICO DE LA NEUROCIENCIA EN LA EDUCACIÓN SUPERIOR. EXPERIENCIAS DE LA UNIVERSIDAD ESTATAL DE BOLÍVAR*. *18*, 165-176. https://doi.org/10.33789/enlace.18.55

Jiménez-Álvarez, L., Fierro-Jaramillo, N., Quichimbo-Miguitama, P., & Capa-Mora, D. (2021). Impact of Learning Strategies in Distance Education on Student

Performance in an Introductory Course of Soil Science. *Revista Electrónica Educare*, *25*(2), 104-119. https://doi.org/10.15359/ree.25-2.6

Marquez-Ramos, L., & Mourelle, E. (2019). Education and economic growth: An empirical analysis of nonlinearities. *Applied Economic Analysis*, *27*(79), 21-45. https://doi.org/10.1108/AEA-06-2019-0005

McGrath, S. (2010). The role of education in development: An educationalist's response to some recent work in development economics. *Comparative Education*, *46*(2), 237-253. https://doi.org/10.1080/03050061003775553

Mendoza Velazco, D., Barreiro, L., Chica, T., Medranda, E., & Chávez, S. (2024). Resilience in vulnerable university groups: An analysis of social work intervention strategies from the perspective of social inclusion. *The Education and science journal*, *26*, 82-102. https://doi.org/10.17853/1994-5639-2024-1-82-102

Moreno, A. T. C., Brito, L. D. D., Mollineda, K. M., Cruz, Y. B. T., & Meza, M. L. L. (2023). Relación de hipertensión arterial con ingesta dietética en adultos mayores del centro gerontológico Buen Vivir. *Revista Conrado*, *19*(94), Article 94.

Navarrete Mendieta, G., Guamán Coronel, M. de los Á., Arteaga Marín, M. I., & Guamán Coronel, D. C. (2020). Aulas virtuales como mediación pedagógica para la inclusión y discapacidades. *Publicaciones: Facultad de Educación y Humanidades del Campus de Melilla*, *50*(2), 31-39.

Ocaña, J., Morales-Urrutia, E., Marín, D., & Pizarro-Romero, C. (2023). About Gamifying an Emotional Learning Companion to Teach Programming to Primary Education Students. *Simulation & Gaming*, *54*, 104687812311750. https://doi.org/10.1177/10468781231175013

Pérez, A. L. M., Santana, N. T., Toledo, I. M., & Fernández, J. A. R. (2021). Color motivated PowerPoint presentation texts and Bioethics learning management. *Atenas*, *2*(54), Article 54.

Pinochet-Quiroz, P., Lepe-Martínez, N., Gálvez-Gamboa, F., Ramos-Galarza, C., del-Valle-Tapia, M., & Acosta-Rodas, P. (2022). Relationship between cold executive functions and self-regulated learning management in college students. *Estudios Sobre Educación*, *43*, 93-113. https://doi.org/10.15581/004.43.005

Price, E. A. C., White, R. M., Mori, K., Longhurst, J., Baughan, P., Hayles, C. S., Gough, G., & Preist, C. (2021). Supporting the role of universities in leading individual and societal transformation through education for sustainable development. *Discover Sustainability*, *2*(1), 49. https://doi.org/10.1007/s43621-021-00058-3

Sánchez-González, J. de J. (1995). EL ANALISIS BIPLOT EN CLASIFICACION. *Revista Fitotecnia Mexicana*, *18*(2), 188-188. https://doi.org/10.35196/rfm.1995.2.188

Sevilla, G. M. L., Aillón, T. M. F., Chicaiza, R. P. M., & Hernández, L. D. R. M. (2019). Métricas y gestión de relación con los clientes en canales sociales del sistema Pontificia Universidad Católica del Ecuador (PUCE). *Dilemas contemporáneos: Educación, Política y Valores*. https://dilemascontemporaneoseducacionpoliticayvalores.com/index.php/dilemas/article/view/935

Shi, Z., & Qamruzzaman, M. (2022). Re-Visiting the Role of Education on Poverty Through the Channel of Financial Inclusion: Evidence From Lower-Income and Lower-Middle-Income Countries. *Frontiers in Environmental Science*, *10*. https://doi.org/10.3389/fenvs.2022.873652

Tessler, M. (2023). Multivariate Analysis: Causation, Control, and Conditionality. En M. Tessler (Ed.), *Social Science Research in the Arab World and Beyond: A Guide for Students, Instructors and Researchers* (pp. 87-133). Springer International Publishing. https://doi.org/10.1007/978-3-031-13838-6_4

Vicente Villardon, J. L. (2010). *MULTBIPLOT: A package for multivariate analysis using biplots*.

Zambrano Briones, M. A., Hernández Díaz, A., Mendoza Bravo, K. L., Zambrano Briones, M. A., Hernández Díaz, A., & Mendoza Bravo, K. L. (2022). El aprendizaje basado en proyectos como estrategia didáctica. *Conrado*, *18*(84), 172-182.

Ziberi, B. F., Rexha, D., Ibraimi, X., & Avdiaj, B. (2022). Empirical Analysis of the Impact of Education on Economic Growth. *Economies*, *10*(4), Article 4. https://doi.org/10.3390/economies10040089