REVISTA INVECOM
ISSN en línea: 2739-0063

Student perceptions on the use of AI and biometric analysis in university neuroeducation processes

Percepción estudiantil sobre el uso de la IA y el análisis biométrico en los procesos de neuroeducación universitaria

Received: 30/04/2026 - **Accepted:** 22/07/2026

Wilson Angel Gutierrez Rodriguez
https://orcid.org/0000-0001-8188-1441
dicytfactec@gmail.com
Universidad Técnica de Oruro. Oruro, Bolivia

Marianela León Mendoza
https://orcid.org/0009-0009-2050-7662
leonmendozamarianela2@gmail.com
Universidad Técnica de Oruro. Oruro, Bolivia

Graciela Mamani Torres
https://orcid.org/0009-0004-6155-2164
docentetutor2020@gmail.com
Universidad San Francisco Xavier. Sucre, Bolivia

Pamela Navarro Escobar
https://orcid.org/0009-0009-4545-9812
navarro.docentetutor@gmail.com
Universidad San Francisco Xavier. Sucre, Bolivia

Abstract

University neuroeducation, strengthened by artificial intelligence and biometric analysis of students, has become an innovative strategy for enhancing teaching and learning processes in higher education. The general objective of this research was to analyze students' perceptions of the use of artificial intelligence (AI) and biometric analysis in university neuroeducation processes. The study was conducted using a quantitative approach, with a non-experimental, cross-sectional, and descriptive-correlational design. The sample consisted of 120 university students who responded to a structured survey based on a Likert-type scale. The instrument was validated by a panel of 10 specialists in education, technology, and scientific research. The results showed that the majority of students perceived the use of AI and educational biometrics favorably, highlighting benefits associated with personalized learning, increased motivation, and improved academic performance. However, concerns related to privacy and the ethical management of biometric data were also identified. It is concluded that these technologies represent an innovative alternative to strengthen the quality of university teaching through more adaptive, humanized processes supported by scientific evidence.

Keywords: neuroeducation, artificial intelligence, educational biometrics, higher education.

Resumen

La neuroeducación universitaria, fortalecida por la inteligencia artificial y el análisis biométrico del estudiantado, se ha consolidado como una estrategia innovadora para potenciar los procesos de enseñanza y aprendizaje en la educación superior. El objetivo general de esta investigación fue analizar la percepción de los estudiantes sobre el uso de la inteligencia artificial (IA) y del análisis biométrico en los procesos de neuroeducación universitaria. El estudio se desarrolló bajo un enfoque cuantitativo, con un diseño no experimental, transversal y descriptivo-correlacional. La muestra estuvo conformada por 120 estudiantes universitarios, quienes respondieron una

encuesta estructurada basada en una escala tipo Likert. El instrumento fue validado por un panel de 10 especialistas en educación, tecnología e investigación científica. Los resultados evidenciaron que la mayoría de los estudiantes percibió favorablemente el uso de la IA y la biometría educativa, destacando beneficios asociados con la personalización del aprendizaje, el incremento de la motivación y la mejora del rendimiento académico. No obstante, también se identificaron preocupaciones relacionadas con la privacidad y la gestión ética de los datos biométricos. Se concluye que estas tecnologías representan una alternativa innovadora para fortalecer la calidad de la enseñanza universitaria mediante procesos más adaptativos, humanizados y sustentados en evidencia científica.

Palabras clave: neuroeducación, inteligencia artificial, biometría educativa, educación superior.

Introduction

University neuroeducation, enhanced by artificial intelligence and student biometric analysis, currently represents one of the most important emerging fields within the digital transformation of contemporary higher education. This area of research integrates knowledge derived from cognitive neuroscience, artificial intelligence, learning analytics, and educational biometrics to achieve a deeper understanding of how university students learn in complex technological environments. According to Luckin (2016), artificial intelligence applied to education promotes personalized learning experiences through algorithms capable of interpreting academic and cognitive behaviors. Similarly, Baker et al. (2021) argue that intelligent technologies strengthen adaptive educational processes and improve interactions among students, teachers, and university digital platforms.

In the Latin American context, the incorporation of artificial intelligence in higher education institutions has increased considerably in recent years due to the accelerated educational digitalization that followed the pandemic. In this regard, Bolivia has not been left out of this transformation, as several universities have begun implementing smart platforms, automated tutoring systems, and biometric tools focused on academic monitoring. According to Cabero-Almenara et al. (2025), higher education institutions face the challenge of integrating emerging technologies while maintaining a balance between innovation, ethics, and pedagogical quality. However, Salas-Pilco et al. (2022) state that Latin American universities still experience limitations related to technological infrastructure, digital literacy, and the protection of biometric data in contemporary educational processes.

The relevance of this topic lies in the fact that university neuroeducation allows for a scientific understanding of the cognitive and emotional mechanisms involved in human learning in digital environments. The integration of artificial intelligence and biometrics enables the identification of patterns associated with attention, motivation, academic stress, and student performance through advanced technological tools. According to D'Mello and Graesser (2014), biometric systems can detect emotions and cognitive states relevant to optimizing university educational experiences. Likewise, Bond et al. (2020) argue that higher education requires pedagogical models based on neuroscientific evidence, capable of strengthening retention, participation, and academic success in hybrid and virtual learning contexts. Furthermore, this topic has gained social relevance due to the problems associated with university dropout rates, low academic participation, and limited educational personalization in Bolivian higher education institutions. In this context, artificial intelligence and biometric analysis could contribute to the early detection of academic and emotional risk factors that affect student performance. According to Holmes et al. (2019), smart technologies have predictive capabilities to identify patterns of academic failure through the automated analysis of behavioral and cognitive data. Furthermore, they strengthen institutional decision-making processes aimed at improving the university experience and student well-being.

However, it is crucial to understand that the use of artificial intelligence and biometrics in university settings also presents a significant scientific and ethical challenge due to the implications associated with privacy, digital surveillance, and the management of sensitive personal data. In Bolivia, many institutions still lack clear policies regulating the pedagogical and ethical use of students' biometric information.

From a pedagogical perspective, another relevant issue concerns the limited teacher training needed to adequately interpret the biometric data generated by intelligent platforms and transform this information into effective teaching strategies. While emerging technologies offer significant analytical opportunities, many university professors still lack the advanced digital skills necessary to integrate these tools into their academic practices. According to Redecker (2017), the digital transformation of education requires strengthening techno-pedagogical competencies related to the critical and reflective use of complex educational data.

Consequently, this research is developed from the theoretical perspective of connectivism and applied neuroeducation, approaches that explain learning as a dynamic process supported by interconnected cognitive, emotional, and technological networks. Connectivism posits that knowledge is constructed through digital interactions mediated by intelligent technologies and collaborative virtual environments. According to Downes

(2019), contemporary learning depends on the ability to establish meaningful connections between information, experiences, and distributed digital resources.

From this perspective, the fundamental principles of the selected theory are associated with brain plasticity, adaptive learning, and the interaction between emotion, cognition, and educational technology. Neuroeducation maintains that learning improves when educational experiences consider neurophysiological and emotional factors that affect university students. According to Immordino-Yang and Damasio (2021), emotions play an essential role in consolidating meaningful learning and in complex cognitive decision-making processes. Similarly, Cuéllar et al. (2025) state that educational artificial intelligence can strengthen academic personalization through biometric analyses designed to detect levels of attention, motivation, and cognitive load during university learning processes.

Regarding previous research, several international studies have addressed the application of artificial intelligence in higher education from neuroscientific, technological, and analytical perspectives. These studies have demonstrated that educational biometrics allows for the collection of relevant information about student engagement, emotions, and academic behavior. According to Chen et al. (2022), facial recognition and the automated analysis of emotional expressions, for example, contribute significantly to understanding the affective states associated with university learning. Similarly, Giannakos et al. (2019) point out that multimodal artificial intelligence systems facilitate more accurate pedagogical feedback processes through the use of biometric and behavioral data.

Likewise, in Latin America, there has been growing scientific interest in the implementation of intelligent technologies aimed at strengthening university learning processes. Several studies conducted in Mexico, Colombia, and Chile have analyzed the impact of artificial intelligence on academic performance, student retention, and educational adaptation. According to Ramírez-Montoya et al. (2023), Latin American universities are progressively moving toward intelligent education models supported by big data, learning analytics, and educational artificial intelligence. In line with this perspective, Area-Moreira and Adell-Segura (2021) state that the digital transformation of universities requires interdisciplinary approaches capable of integrating technological innovation, human well-being, and comprehensive cognitive development.

In summary, previous studies have demonstrated that educational artificial intelligence has great potential to strengthen personalized and predictive teaching and learning processes in contemporary higher education. Furthermore, the aforementioned research highlighted that biometric analysis allows for the understanding of invisible variables of human learning that traditionally could not be measured using conventional methodologies. According to Giannakos et al. (2019), biometric sensors applied in educational contexts allow for the identification of attentional fluctuations and levels of cognitive engagement during virtual academic activities.

On the other hand, it is important to note that the scientific literature has also revealed ethical concerns associated with the widespread use of biometric data in university educational institutions. While intelligent technologies offer significant advantages for learning analysis, as has been demonstrated, several researchers have warned about the risks related to privacy, informed consent, and the digital surveillance of students. According to Prinsloo and Slade (2017), educational analytics must be based on transparent ethical principles that protect the rights and freedoms of university students. Similarly, Knox et al. (2019) argue that universities need to develop robust regulatory frameworks focused on the responsible use of algorithms and biometric technologies in digital educational environments.

Based on this background, the present study seeks to answer the following question: How do students perceive the use of artificial intelligence and biometric analysis in university neuroeducation processes within the context of higher education? This question arises from the need to understand the extent to which intelligent technologies contribute to strengthening personalized, inclusive, and neuroscience-based educational experiences. In this sense, the general objective of the research is to analyze students' perceptions of the use of artificial intelligence and biometric analysis in university neuroeducation processes within the context of Bolivian higher education, identifying their pedagogical, neurocognitive, and ethical implications for academic performance.

Therefore, the research hypothesizes that students' perceptions of the use of artificial intelligence and biometric analysis in university neuroeducation processes are favorable within the context of Bolivian higher education. Specifically, it is proposed that personalized learning, based on neurophysiological data and predictive algorithms, enhances student attention, motivation, and participation throughout the educational process. Furthermore, it is argued that the ethical and pedagogically sound integration of biometric technologies strengthens faculty decision-making aimed at reducing academic dropout rates and improving the quality of university education.

Methodology

This research was conducted using an empirical-quantitative approach, as its purpose was to analyze students' perceptions of the use of artificial intelligence and biometric analysis in university neuroeducation

processes within the context of higher education. This was achieved through the collection and analysis of objective data obtained directly from the study population. The design was non-experimental and cross-sectional, since the variables were observed in their natural context, without deliberate manipulation by the researchers. Furthermore, the scope of the study was descriptive-correlational, which allowed for the identification of the main characteristics of the analyzed phenomenon and the establishment of the relationship between the use of artificial intelligence tools, biometric analysis, and university learning processes. According to Hernández-Sampieri and Mendoza (2018), quantitative studies allow for the measurement of educational phenomena through systematic procedures aimed at obtaining verifiable results.

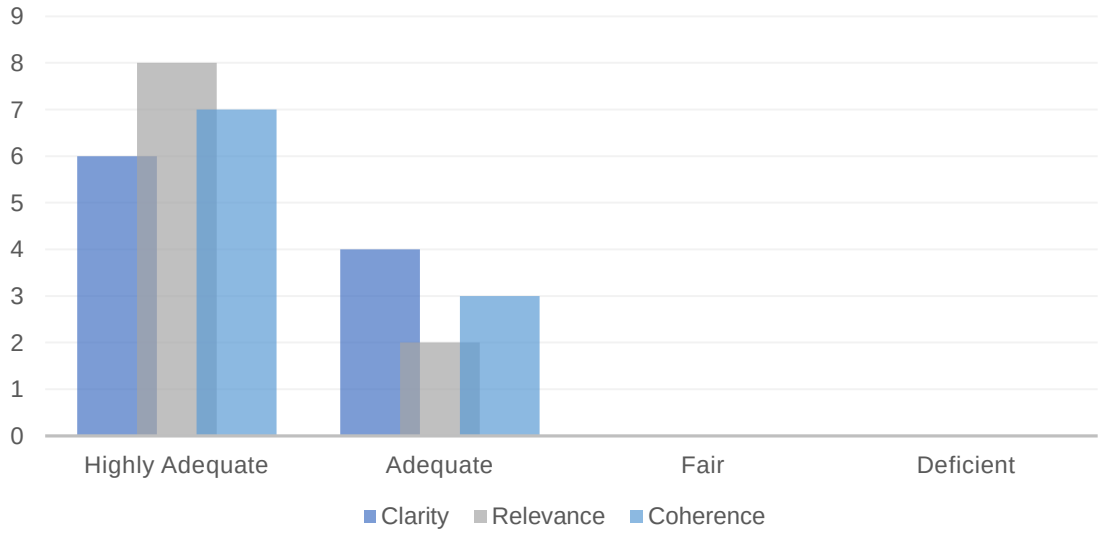
The population consisted of 120 university students from higher education institutions in Bolivia, selected through convenience sampling due to their accessibility and willingness to participate in the research process. The participants belonged to different university programs associated with digital and technological environments, considering inclusion criteria related to the frequent use of virtual learning platforms and educational technologies. Since the population was relatively small and accessible, the entire population was included in the study; therefore, no sampling formula was required. This decision made it possible to obtain a comprehensive overview of the behavior of the analyzed variables within the selected academic context.

For data collection, the survey technique was used due to its ability to obtain direct information about students' perceptions, experiences, and evaluations regarding the use of artificial intelligence and educational biometrics. A structured questionnaire with closed-ended questions was designed as the research instrument, based on a five-point Likert scale with the following response options: “strongly disagree,” “disagree,” “neutral,” “agree,” and “strongly agree.” The instrument was organized into dimensions related to neuroeducation, educational artificial intelligence, technological perception, and student biometric analysis. Furthermore, the items were written in technical but accessible language to ensure their adequate comprehension by the participating university students.

Regarding instrument validation, this process was carried out through the evaluation of 10 specialists with experience in higher education, neuroeducation, artificial intelligence, and research methodology. The objective of this process was to assess the clarity, relevance, and coherence of the items included in the questionnaire administered to the university students. The experts analyzed each question, considering its relationship to the research objectives and the thematic consistency of the dimensions being evaluated. The results obtained allowed for the identification of a favorable level of acceptance and validity of the instrument designed for the study.

Figure 1

General results of instrument validation according to specialist criteria



Note. The evaluations reflected adequate methodological consistency and thematic alignment between instrument items and research objectives / **Source.** Prepared by the authors

The analysis of the results showed that the specialists issued highly favorable evaluations regarding the methodological quality of the instrument designed for the study. The criteria of relevance and coherence received the highest number of “highly adequate” ratings, demonstrating that the items were directly aligned with the objectives and variables proposed in the research. Likewise, all specialists approved the questionnaire for its final application, indicating that the instrument presented thematic consistency, appropriate wording, and sufficient capacity to collect relevant information on neuroeducation, artificial intelligence, and university educational biometrics.

Regarding the methodological procedure, it began with institutional authorization and informed consent from the participating students, thereby ensuring the ethical principles of confidentiality, anonymity, and responsible use of the collected information. Subsequently, the questionnaire was administered virtually through digital forms distributed to the selected students. Data collection took place during a regular academic term, allowing participants to respond freely and voluntarily. Once the information was obtained, the data were organized and tabulated in spreadsheets to facilitate statistical processing and interpretation of the results.

Finally, data analysis was carried out through descriptive statistics, using frequencies, percentages, and comparative tables that enabled the interpretation of the behavior of the investigated variables. This procedure facilitated the identification of trends related to student perceptions regarding the use of artificial intelligence and biometrics within university neuroeducation processes. Likewise, the results were interpreted in light of the established objectives and the theoretical framework developed throughout the study, allowing coherent conclusions to be drawn in relation to the problem under investigation in the Bolivian university context.

Results

The following section presents the results obtained from the application of the instrument administered to Bolivian university students, with the purpose of analyzing students' perceptions regarding the use of artificial intelligence and biometric analysis in university neuroeducation processes within the context of higher education. The data collected allowed for the identification of experiences and evaluations associated with the use of intelligent technologies in academic environments. Likewise, the findings revealed significant trends regarding the acceptance of AI-based tools, their impact on learning processes, and the relevance of biometric analysis for strengthening personalized educational processes in higher education institutions.

Results of the survey administered to students

The survey conducted with 120 university students provided relevant information regarding their level of knowledge, acceptance, and perception of the use of artificial intelligence and educational biometrics in teaching-learning processes. The results showed a positive attitude toward the implementation of intelligent technologies in university contexts, particularly in aspects related to academic personalization, improved student performance, and the strengthening of digital educational experiences. The following statistical tables present the responses obtained through the Likert-scale instrument.

Table 1

Student perceptions on the use of artificial intelligence in university learning

Options	Frequency	Percentage	Cumulative Percentage
Strongly disagree	6	5%	5%
Disagree	10	8%	13%
Neutral	18	15%	28%
Agree	46	38%	66%
Strongly agree	40	34%	100%
Total	**120**	**100%**	

Note: Positive perceptions regarding the use of artificial intelligence in university learning processes predominated / **Source:** Prepared by the authors

The table shows that the options “Agree” (38%) and “Strongly agree” (34%) were the predominant responses among the surveyed students. These results indicate that the majority of participants believe that artificial intelligence has a positive impact on university learning processes, promoting more dynamic and personalized

academic experiences. Furthermore, there is a clear positive perception of the use of smart technologies in educational settings, reflecting a growing acceptance among students of innovative digital tools designed to enhance academic performance and optimize university teaching processes.

Table 2
Level of acceptance of biometric analysis in educational processes

Options	Frequency	Percentage	Cumulative Percentage
Strongly disagree	8	7%	7%
Disagree	14	12%	19%
Neutral	20	17%	36%
Agree	44	37%	73%
Strongly agree	34	27%	100%
Total	**120**	**100%**	

Note. Most students accepted biometric analysis as a supportive tool in university educational processes / **Source.** Prepared by the authors

The results indicated that the categories “Agree” (37%) and “Strongly agree” (27%) accounted for the highest number of responses among the participating students. This demonstrates a positive perception of the use of biometric analysis in university contexts, particularly as a tool for understanding academic and emotional behaviors. Furthermore, the students considered that biometrics could contribute to improving personalized educational processes and strengthening academic monitoring. However, a moderate percentage of neutral and negative responses was also identified, possibly associated with ethical concerns related to privacy and the management of personal data.

Table 3
Importance of artificial intelligence for improving academic performance

Options	Frequency	Percentage	Cumulative Percentage
Strongly disagree	5	4%	4%
Disagree	11	9%	13%
Neutral	16	13%	26%
Agree	48	40%	66%
Strongly agree	40	34%	100%
Total	**120**	**100%**	

Note. Students recognized that artificial intelligence contributes to strengthening university academic performance / **Source.** Prepared by the authors

The information presented shows that the responses “Agree” (40%) and “Strongly agree” (34%) were the most prevalent among the university students. These results indicate that the participants recognized the importance of artificial intelligence as a tool capable of strengthening academic performance and optimizing learning experiences. Likewise, the evidence showed that students perceived benefits related to educational personalization, access to digital resources, and improvements in academic organization. Consequently, artificial intelligence was valued as a strategic technology in contemporary university educational processes.

Table 4
Perception regarding the ethical use of student biometric data

Options	Frequency	Percentage	Cumulative Percentage
Strongly disagree	12	10%	10%
Disagree	18	15%	25%
Neutral	24	20%	45%
Agree	38	32%	77%
Strongly agree	28	23%	100%
Total	**120**	**100%**	

Note. Moderate acceptance was identified regarding the ethical use of biometric data within university environments / **Source.** Prepared by the authors

The analysis of the findings showed that the options “Agree” (32%) and “Strongly agree” (23%) were the most frequently selected responses among the university students. This indicates a relatively favorable perception of the ethical use of biometric data in educational processes, provided that confidentiality and the protection of personal information are guaranteed. Likewise, the results revealed that a significant proportion of students held neutral or disagreeing views, reflecting concerns related to privacy, digital surveillance, and the potential risks associated with the inappropriate management of biometric information within university institutions.

Table 5
Student perceptions of the relationship between smart technologies and motivation

Options	Frequency	Percentage	Cumulative Percentage
Strongly disagree	7	6%	6%
Disagree	13	11%	17%
Neutral	19	16%	33%
Agree	45	38%	71%
Strongly agree	36	29%	100%
Total	**120**	**100%**	**100%**

Note. Intelligent technologies were perceived as tools that increase student academic motivation / **Source.** Prepared by the authors

The results revealed that “Agree” (38%) and “Strongly Agree” (29%) were the predominant responses among the university students surveyed. This data suggests that smart technologies positively influence academic motivation by fostering greater student participation and engagement in the learning process. Furthermore, participants felt that AI-based tools create more dynamic, interactive, and adaptive learning experiences. Consequently, there is a clear positive perception of incorporating innovative technologies into the current university context.

Discussion

The results obtained demonstrate that the use of artificial intelligence has a positive impact on university learning processes, especially in aspects related to educational personalization, access to digital resources and the strengthening of academic performance. In general, the majority of students expressed favorable perceptions regarding the incorporation of intelligent technologies in university environments, which coincides with what was pointed out by Cabero-Almenara et al. (2025), who maintain that artificial intelligence optimizes educational experiences through adaptive environments. Likewise, Pazmiño (2024) states that personalized learning constitutes one of the main advantages derived from the integration of technology in contemporary higher education.

Similarly, the findings revealed that students recognized the importance of biometric analysis as a supportive tool for understanding academic and emotional behaviors during university educational processes. These results are related to the investigations conducted by D'Mello and Graesser (2014), who explained that affective technologies enable the identification of emotional states associated with attention and learning. Furthermore, Agualsaca et al. (2025) maintained that affective neuroscience applied to digital educational environments promotes students' socioemotional development, strengthening more humanized and cognitively meaningful academic experiences within contemporary university institutions.

On the other hand, the results reflected that intelligent technologies significantly contributed to increasing students' academic motivation, promoting greater participation in university activities mediated through digital platforms. This situation is consistent with the findings of Bond et al. (2020), who indicated that educational technologies increase student engagement through interactive and dynamic learning experiences. Likewise, Zaragoza (2026) affirmed that artificial intelligence promotes academic personalization processes that strengthen motivation, autonomy, and student retention within university contexts characterized by accelerated digital transformation and new pedagogical demands.

Nevertheless, the research also revealed concerns associated with the ethical use of biometric data and the protection of personal information within digitalized university environments. Although most students demonstrated acceptance of the use of educational biometrics, a significant proportion expressed neutral or distrustful positions regarding privacy and technological surveillance. These findings are related to the perspectives proposed by Prinsloo and Slade (2017), who warned about the ethical risks derived from the massive collection of educational data. Likewise, Durand et al. (2026) maintained that cognitive privacy currently represents a priority challenge within educational systems based on artificial intelligence.

Furthermore, the obtained findings made it possible to identify that artificial intelligence has the potential to significantly improve academic performance through adaptive tools aimed at personalized monitoring of university learning. Students considered that these technologies facilitate immediate access to information, automated feedback, and more efficient educational experiences. These results coincide with Chen et al. (2022), who explained that educational artificial intelligence optimizes academic processes through automated analyses and intelligent recommendation systems. Similarly, Estrella (2025) argued that generative artificial intelligence strengthens personalized formative assessment processes, promoting more dynamic and contextualized learning experiences in higher education.

Regarding teaching competencies, the study indirectly evidenced the need to strengthen techno-pedagogical capacities in order to adequately integrate artificial intelligence and educational biometrics into university practice. Although students perceived significant benefits associated with these technologies, they also recognized that their effectiveness depends on the academic and methodological support provided by instructors. These findings coincide with Noriega et al. (2026), who maintained that digital pedagogical competencies represent a key factor in the success of educational artificial intelligence. Likewise, Ramírez-Montoya et al. (2023) indicated that technological innovation in universities requires continuous specialized teacher training.

Another relevant aspect identified in the investigation corresponds to the need to maintain a balance between technological innovation and educational humanization within contemporary university processes. Although intelligent technologies facilitate more efficient and personalized academic experiences, students also valued human interaction as an essential component of meaningful learning. This situation is consistent with the arguments proposed by Cuéllar et al. (2025), who affirmed that neuroeducation must integrate technological and emotional dimensions in order to strengthen comprehensive cognitive processes. Furthermore, Downes (2019) maintained that contemporary learning depends both on digital connections and collaborative human interactions within dynamic educational networks.

Likewise, the results made it possible to understand that student acceptance of artificial intelligence and educational biometrics responds to the growing digital transformation occurring within Latin American universities. New university generations demonstrated greater openness toward technological tools capable of optimizing academic experiences and strengthening autonomous learning processes. This reality coincides with Bastidas (2024), who affirmed that higher education faces a prospective scenario characterized by the accelerated integration of artificial intelligence into educational environments. Similarly, Núñez et al. (2026) maintained that intelligent technologies promote the development of autonomous learning, although they also generate important ethical and pedagogical challenges.

Finally, the obtained findings made it possible to conclude that university neuroeducation enhanced by artificial intelligence and biometric analysis represents an innovative alternative for strengthening teaching-learning processes within Bolivian higher education institutions. However, its implementation requires ethical policies, teacher training, and institutional strategies aimed at ensuring a balance between technological innovation and

student well-being. These results are related to the perspectives proposed by Crompton and Burke (2023), who maintained that educational artificial intelligence should be implemented through comprehensive and humanized approaches. Likewise, Freire et al. (2026) warned that the excessive use of intelligent technologies could generate cognitive dependency in the absence of appropriate pedagogical support.

Conclusions

The research demonstrated that artificial intelligence has a positive impact on university neuroeducation processes, promoting more personalized, dynamic, and adaptive learning experiences within the context of Bolivian higher education. Students acknowledged that smart technologies strengthen access to academic resources and contribute to optimizing educational performance.

The results showed that student biometric analysis is a relevant tool for understanding emotional, cognitive, and behavioral factors associated with university learning. Most participants considered that these technologies could significantly contribute to academic monitoring and the early identification of student difficulties.

It was identified that intelligent technologies increase students' academic motivation and participation, promoting greater interaction within digital educational environments. Students perceived that artificial intelligence facilitates more innovative, interactive, and autonomous university learning experiences.

The investigation determined that concerns related to privacy, ethics, and the responsible management of biometric data exist within university institutions. Although favorable perceptions toward these technologies predominated, the need to establish clear regulations to ensure the protection and confidentiality of student information was also evident.

The findings reflected the importance of strengthening teachers' digital and techno-pedagogical competencies in order to adequately integrate artificial intelligence tools into university educational processes. The effectiveness of these technologies depends significantly on the academic and methodological preparation of the instructors responsible for their implementation.

Finally, it was concluded that university neuroeducation enhanced by artificial intelligence and biometrics represents an innovative alternative for improving educational quality in Bolivia. Nevertheless, its implementation requires a balance among technological innovation, pedagogical humanization, and student well-being in order to guarantee ethical, inclusive, and sustainable educational processes.

References

Agualsaca Calle, D. A., Martínez Hidalgo, F. A., Veintimilla Rizzo, L. M., & Moreno Villalva, E. P. (2025). Neurociencia afectiva y tecnología educativa: el impacto de las emociones en el aprendizaje y el desarrollo socioemocional. *Sapiens in Education, 2*(4), 1–16. https://doi.org/10.71068/1zb2pj75

Area-Moreira, M., & Adell-Segura, J. (2021). Tecnologías digitales y cambio educativo. Una aproximación crítica. *REICE: Revista Iberoamericana de Educación a Distancia, 24*(2), 9–21. https://dialnet.unirioja.es/servlet/articulo?codigo=8086687

Baker, T., Smith, L., & Anissa, N. (2021). *Educ-AI-tion rebooted? Exploring the future of artificial intelligence in schools and colleges*. Nesta. https://www.nesta.org.uk/report/education-rebooted/

Bastidas González, L. D. (2024). Inteligencia artificial y educación superior: un análisis prospectivo de los desafíos y oportunidades. *Sapiens in Higher Education, 1*(1), 1-17. https://sapiensjournal.ec/index.php/sihe/article/view/42

Bond, M., Buntins, K., Bedenlier, S., Zawacki-Richter, O., & Kerres, M. (2020). Mapping research in student engagement and educational technology in higher education: a systematic evidence map. *International Journal of Educational Technology in Higher Education*, *17*, 2. https://link.springer.com/article/10.1186/s41239-019-0176-8#citeas

Cabero-Almenara, J., Palacios, A., Llorente-Cejudo, C., & Barroso-Osuna, J. (2025). Aceptación de ChatGPT en educación superior: Actitudes y percepciones del modelo UTAUT2. *REICE. Revista Iberoamericana sobre Calidad, Eficacia y Cambio en Educación, 24*(1). https://doi.org/10.15366/reice2026.24.1.001

Chen, L., Chen, P., & Lin, Z. (2022). Artificial intelligence in education: A review. *IEEE Access, 10*, 75264–75278. https://ieeexplore.ieee.org/document/9069875

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*, 22. https://doi.org/10.1186/s41239-023-00392-8

Cuéllar Gaitan, R. A., Betancourt Perdomo, J. D., & Rosales Vidal, E. (2025). Neuroeducación e inteligencia artificial en contexto educativo: estrategias emergentes para la mejora del rendimiento cognitivo. *Imperium Académico. Revista Científica,* 2(4), 1-13.

https://www.researchgate.net/publication/394573636_Neuroeducacion_e_inteligencia_artificial_en_contexto_educativo_estrategias_emergentes_para_la_mejora_del_rendimiento_cognitivoNeuroeducation_and_Artificial_Intelligence_in_Educational_Contexts_Emergin

D'Mello, S., & Graesser, A. C. (2014). Feeling, thinking, and computing with affect-aware learning technologies. In R. A. Calvo, S. K. D'Mello, J. Gratch, & A. Kappas (Eds.), *The Oxford handbook of affective computing*. Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199942237.013.032

Downes, S. (2019). Recent work in connectivism. *European Journal of Open, Distance and E-Learning, 22*(2), 113–132. https://eurodljournal.com/articles/10.2478/eurodl-2019-0014

Durand Goyzueta, E. A., Condori Mamani, B., Ramos Chura, E., Avila Inquilla, V. E., Salinas del Carpio, A., Ito Díaz, R. R., & Hilasaca Zea, C. Y. (2026). Cognitive privacy and the use of artificial intelligence in digital platforms for higher education. *NeuroData, 3*, 160. https://doi.org/10.63688/neurodata2026160

Estrella Romero, V. A. (2025). Impacto de la inteligencia artificial generativa en la evaluación formativa universitaria personalizada. *Sapiens in Higher Education, 2*(10), 1–14. https://doi.org/10.71068/fw0q7v55

Freire Palacios, V. A., Torres Vizuete, R. E., Alcivar Cuenca, P. E., Cedeño Casquete, G. C., & Ordóñez Ruiz, M. M. (2026). Uso de inteligencia artificial y dependencia cognitiva en estudiantes universitarios. *Sage Sphere of Technology, Sciences, Discoveries and Society, 4*(1), 1-23. https://doi.org/10.63688/znqmqg17

Giannakos, M., Sharma, K., Pappas, I., Kostakos, V., & Velloso, E. (2019). Multimodal data as a means to understand the learning experience. *International Journal of Information Management, 48*, 108-119. https://www.sciencedirect.com/science/article/pii/S0268401218312751?via%3Dihub

Hernández-Sampieri, R. & Mendoza, C (2018). *Metodología de la investigación. Las rutas cuantitativa, cualitativa y mixta*. Mc Graw Hill Education.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign. https://www.consorciosthem.com/wp-content/uploads/2025/02/sthem-ia-07-holmes-fadel-bialik-artificial-intelligence-in-education-promise-and-implications-for-teaching-and-learning-2019.pdf

Immordino-Yang, M., & Damasio, A. (2021). We feel, therefore we learn: The relevance of affective and social neuroscience to education. *Mind, Brain, and Education, 1,* 3-10. https://doi.org/10.1111/j.1751-228X.2007.00004.x

Knox, J., Wang, Y., & Gallagher, M. (2019). *Artificial intelligence and inclusive education speculative futures and emerging practices: Speculative futures and emerging practices*. Springer Singapore. https://link.springer.com/book/10.1007/978-981-13-8161-4#accessibility-information

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson. https://www.pearson.com/content/dam/one-dot-com/one-dot-com/global/Files/about-pearson/innovation/open-ideas/IntelligenceUnleashedSPANISH.pdf

Noriega Medina, M. B., Romero Berrones, W. J., Manssur Ponce, I. M., Hidalgo Solórzano, J. L., & Contento Castillo, R. A. (2026). Uso de herramientas de inteligencia artificial y competencias pedagógicas en docentes de educación superior. *Sage Sphere Multidisciplinary Studies, 3*(1), 1-23. https://doi.org/10.63688/6b6qwk94

Núñez Cayetano, A. M., Lopez Torres, M. F., Strasser López, K. L., & Herrera Vera, D. E. (2026). Inteligencia artificial en la educación: beneficios, desafíos éticos y su impacto en el aprendizaje autónomo. *Sapiens in Artificial Intelligence, 3*(2), 1-16. https://doi.org/10.71068/jgk10c67

Pazmiño Arcos, A. F. (2024). Revolucionando la educación superior: inteligencia artificial para el aprendizaje personalizado y la transformación docente. *Sage Sphere of Technology, Sciences, Discoveries and Society, 2*(2), 1-13. https://doi.org/10.63688/ftdznh26

Prinsloo, P., & Slade, S. (2017). Ethics and learning analytics: Charting the (un)charted. In C. Lang, G. Siemens, A. F. Wise, & D. Gašević (Eds.), *Handbook of learning analytics* (pp. 49–57). Society for Learning Analytics Research. https://doi.org/10.18608/hla17.004

Ramírez-Montoya, M.S., González, C. S. G., Montoya, D. H., Lopez-Caudana, E. O., & Rodríguez-Abitia, G. (Eds.) (2023). *Open education for sustainable development: Contributions from emerging technologies and educational innovation*. Frontiers Media S. A. https://hdl.handle.net/11285/651091

Redecker, C. (2017). *European Framework for the Digital Competence of Educators: DigCompEdu*. Publications Office of the European Union. https://publications.jrc.ec.europa.eu/repository/handle/JRC107466

Salas-Pilco, S. Z., Xiao, K., & Oshima, J. (2022). Artificial intelligence and new technologies in inclusive education for minority students: A systematic review. *Sustainability, 14*(20), 13572. https://www.mdpi.com/2071-1050/14/20/13572

Zaragoza Alvarado, G. A. (2026). Influencia de la Inteligencia Artificial en los procesos de personalización del aprendizaje en la educación superior. *Sapiens in Artificial Intelligence, 3*(1), 1-15. https://doi.org/10.71068/asq6b765

AUTHOR CONTRIBUTIONS:

Wilson Angel Gutierrez Rodriguez: Conceptualization; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Supervision; Visualization; Writing – original draft.

Marianela León Mendoza: Conceptualization; Data curation; Investigation; Resources; Supervision; Validation; Writing – review and editing.

Graciela Mamani Torres: Data curation; Investigation; Validation; Writing – original draft.

Pamela Navarro Escobar: Formal analysis; Investigation; Methodology; Software; Visualization; Writing – review and editing.