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Evaluación estadística con SPSS y Python del impacto integral generado por la asistencia de inteligencia artificial en docentes ecuatorianos

Statistical evaluation with SPSS and Python of the integral impact generated by artificial intelligence assistance in Ecuadorian teachers

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Palabras claves:
Docencia, inteligencia artificial, conocimiento, capacitación, reducción de estrés.

Resumen

Introducción. La inteligencia artificial está transformando la educación mediante la personalización del aprendizaje, la gestión escolar y el análisis de datos educativos. Sin embargo, persisten desafíos en su implementación, destacando la necesidad de capacitación docente en IA. Su uso puede liberar a los docentes de tareas rutinarias, pero enfrenta obstáculos económicos y tecnológicos, especialmente en LATAM**. Objetivo.** Investigar cómo los docentes pueden utilizar herramientas de Inteligencia Artificial para potenciar su labor, identificar los retos asociados, evaluar la necesidad de capacitaciones y explorar el uso de la IA para reducir el estrés laboral. **Metodología.** El enfoque metodológico utilizado en esta investigación es mixto, combinando datos cuantitativos de encuestas con análisis cualitativo bibliográfico. Se usaron SPSS estadístico descriptivo de respuestas cerradas y Python para el análisis de preguntas abiertas, respectivamente. **Resultados.** El análisis estadístico inferencial con SPSS revela que solo el 15.4% de los docentes conoce las herramientas de IA en educación, mientras que el 61.5% no. El 76.9% ha recibido capacitación en IA, pero el 100% cree que reduce el estrés laboral. La IA mejora la gestión del tiempo y facilita tareas administrativas. **Conclusión.** La integración de IA en educación optimiza la gestión del tiempo y facilita tareas administrativas y pedagógicas de los docentes, permitiendo mayor dedicación a la enseñanza personalizada. Aunque popular, la falta de capacitación y habilidades técnicas son desafíos para superar. Es crucial invertir en formación técnica el respecto. La IA reduce el estrés laboral y mejora la calidad ambiente educativo para los docentes. **Área de estudio general:** Docencia. **Área de estudio específica:** Inteligencia artificial. **Tipo de estudio:** Artículos originales.

Keywords:
Teaching, artificial intelligence, knowledge, training, stress reduction.

Abstract

Introduction. Artificial intelligence is transforming education through the personalization of learning, school management and educational data analysis. However, challenges persist in its implementation, highlighting the need for teacher training in AI. Its use can free teachers from routine tasks, but it faces economic and technological obstacles, especially in LATAM. objective. Investigate how teachers can use AI tools to enhance their work, identify associated challenges, assess the need for training and

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explore the use of AI to reduce work-related stress. Methodology. The methodological approach used in this research is mixed, combining quantitative survey data with qualitative bibliographic analysis. SPSS descriptive statistics for closed-ended responses and Python were used for the analysis of open-ended questions, respectively. Results. Inferential statistical analysis with SPSS reveals that only 15.4% of teachers are aware of AI tools in education, while 61.5% are not. 76.9% have received training in AI, but 100% believe that it reduces work stress. AI improves time management and facilitates administrative tasks. Conclusion. The integration of AI in education optimizes time management and facilitates teachers' administrative and pedagogical tasks, allowing greater dedication to personalized teaching. Although popular, the lack of training and technical skills are challenges to overcome. It is crucial to invest in technical training in this regard. AI reduces work stress and improves the quality of the educational environment for teachers.

Introduction

Artificial Intelligence (AI) is currently transforming education by enabling the personalization of learning, improving school management, and analyzing educational data. However, there can be shortcomings in the educational system when using these technologies. So it is crucial for teachers to be trained in AI to stay up to date in the educational environment alongside many of their students. It has been scientifically proven that the regular use of AI assistance in the tasks of the teaching workday inside and outside the institution can free teachers from routine, exhausting tasks and provide them with tools to improve their practice. However, its incorporation poses economic and educational challenges with the teaching staff still struggling with the basic use of ICTs. Increase efforts to "learn to learn" new things and understand that the essence of teaching work transcends content.

The potential benefits of AI in Education can be achieved in multiple ways, such as personalizing learning, reducing work stress, analyzing data to improve decision-making, automating administrative tasks and supporting students with special needs, integrating knowledge, and more. On the other hand, in LATAM countries there are still challenges in the formal incorporation of this technology in Education. Although AI offers great opportunities, teachers face various challenges when trying to integrate it into their pedagogical practices, such as lack of training and technological limitations.

This analysis is justified by the relevance of the Research for the Educational Community in Ecuador, since investigating the use of AI in education is crucial to take advantage of its benefits and address the challenges that teachers face with changes that can improve the quality of teaching and their well-being. The need to carry out this research lies in the importance of providing answers to the following questions raised by a large majority of the Ecuadorian teaching community, which are considered the basis of this research:

How can multiple AI tools be used to enhance teaching?

What are the challenges that educators face when incorporating AI into their teaching tools?

Should the state offer training on the use of AI in teaching?

Can AI be used as a strategy to reduce teacher job stress?

Objective: To investigate how teachers can use Artificial Intelligence tools to enhance their work, identify associated challenges, assess the need for training, and explore the use of AI to reduce work stress.

Methodology

The methodological approach used in this research is mixed. It is a quantitative approach, since data was collected through surveys of teachers from different institutions, providing numerical data and allowing statistical analysis of the responses (Vidal, 2022). On the other hand, according to Valle et al. (2022), this is a qualitative approach, due to the bibliographic research that helped to contextualize and deepen the results of the surveys applied to teachers. Through this approach, previous studies, theories and related findings were examined, providing a theoretical framework and qualitative analysis that will support and interpret the quantitative data obtained from the surveys. In addition, interviews have been conducted to obtain detailed information and professional perspectives from teachers with extensive experience in teaching and the use of ICTs, in order to add an extra qualitative component.

Thus, the mixed approach according to Albayero et al., (2020) complements the quantitative data from the surveys, providing a broad and generalizable view of trends and perceptions among teachers. The qualitative data obtained from the literature review and interviews provided a deeper and more detailed context, in order to better understand the reasons and experiences underlying the quantitative responses. At the same time, data triangulation as a strategy in educational research for Aguilar & Barroso (2015), allows the use of multiple data sources and analysis methods, improving the validity and reliability of the results presented in this study; that is, it seeks to confirm the findings and provide a more robust and complete understanding of the phenomenon studied.

Aim

Investigate how teachers can use AI tools to enhance their work, identify associated challenges, assess the need for training, and explore the use of AI to reduce workplace stress.

Participants

The participants in this study are teachers from different institutions in the central area of Ecuador, since there are teachers who work in educational institutions located in the cities of Quito, Aloasig, Sigchos, Latacunga and El Tingo-Pujilí.

The teachers participating in this study were 35% men and 65% women, of which 12% work in private educational institutions and 65% of them in public institutions of the Ministry of Education of Ecuador. There are teachers with around 2 to more than 20 years of experience, who have worked in basic and high school education, in different areas of study.

Sample inclusion criteria

The inclusion principle for the sample was based on the voluntary participation of teachers. Specific inclusion criteria were established: the teachers who participated did so freely and voluntarily, without coercion or material incentives. In addition, teachers from various educational institutions were included, covering different educational levels and school contexts, to ensure institutional diversity. Teachers with different years of teaching experience were also considered, which allowed for a broad and representative perspective.

Quantitative analysis using descriptive statistics with SPSS for the closed questions of the survey

The structure of the information collection instrument applied to the sample of teachers who participated in this study is presented in Table 1.

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Table 1

Closed survey structure

Closed Questions	Spotlight analysis	Bibliographic support
Do you know about AI tools applied in education?	Knowledge of educational tools of AIs	Fernandez (2023) Jimenez & Hinojoza (2023) Sanz (2024) Flores-Vivar & Garcia-Peñalvo (2023)
Have you received specific training in the use of artificial intelligence tools in your workday?	Training and Capacity Building in AI	Apollo et al. (2024) Jimenez & Hinojoza (2023) Lagares et al. (2022) Rodriguez et al. (2023)
Do you think that the use of AI reduces stress during the work day and would improve the quality of working life for teachers?	Mitigation of work stress	Jimenez & Hinojoza (2023) Najar (2024) Sosa et al. (2021) Tramallino & Zeni (2024)
How much do you know about AI tools applied in education?	Popularity of AI educational tools	Apollo et al. (2024) Fernandez (2023) Najar (2024) Sanz (2024) Verbrugge et al. (2021)

Note: Due to the nature of these questions, they were only answered "Yes" or "No".

Data from the survey on the use of artificial intelligence in education were imported into SPSS software. Variables were defined as nominal or ordinal.

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Quantitative analysis using descriptive statistics with Python for open-ended survey questions

The structure of the information collection instrument applied to the teacher sample that participated in this study is presented in the following table. This section focused on open questions.

Table 2

Structure of the information collection instrument for open questions

Closed Questions	Spotlight analysis	Previous research
What is your verdict on AI after using it to perform everyday teaching work activities?	Choosing AI to perform activities	Apollo et al. (2024) Fernandez, 2023) Najar (2024) Verbrugge et al. (2021)
What are those challenges and how have you overcome them?	Challenges and overcoming with AI	Lema & Chérrez (2023) Reina et al. (2019)
AI reduces work stress: Why do you think so?	Reducing Workplace Stress with AI	Jimenez & Hinojoza (2023) Najar (2024) Sosa et al. (2021) Tramallino & Zeni (2024)

First, the data to be analyzed was transcribed into a manageable structure in Python. Data coding and analysis was performed; that is, the main themes of the responses were extracted according to previous relevant bibliographic research and the frequencies of said themes were analyzed in the responses provided by the surveyed teachers.

Development

Since descriptive statistics collects, organizes, summarizes, and presents data in an informative manner, it was the optimal study path for this case (Calvo, 2020), it was necessary to use measures such as mean, median, standard deviation, and graphs to accurately describe the most important characteristics of the data obtained in the survey conducted with teachers without making inferences or predictions about a broader population.

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Quantitative analysis using descriptive statistics with SPSS for the closed questions of the survey

The Statistical Package for the Social Sciences (SPSS) statistical data analysis software was used as it facilitates the management and analysis of large volumes of data (IBM, 2024), since it required performing statistical tests on all the surveys conducted.

First, a descriptive statistical analysis was performed to obtain frequencies and percentages of the key variables. The "Analyze" option was used within this "Descriptive Statistics" and the "Percentages" option was chosen, such as knowledge about AI, training in AI and perception of stress reduction with the use of AI. Obtaining what is presented in Table 3.

Table 3

Statistics: frequency analysis with descriptive statistics

	How much do you know about AI tools applied in education?	Training and Capacity Building: Have you received specific training in the use of artificial intelligence tools in your workday?	Work stress: Do you think that the use of AI reduces stress during the work day and would improve the quality of work life for teachers?	Do you know about AI tools applied in education?
Average	1.80	1.80	1.00	1.00
Median	2.00	2.00	1.00	1.00
Standard deviation	,422	,422	,000	,000
Variance	,178	,178	,000	,000

Popularity of AI educational tools

Table 4 presents the results obtained from the processing of the responses to the closed question about the popularity of artificial intelligence educational tools, carried out with quantitative analysis using descriptive statistics with the SPSS statistical program, which reflects the percentages of responses, valid and accumulated percentages.

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Table 4

Frequency table for the question How much do you know about AI tools applied in education?

		Percentage	Valid percentage	Cumulative percentage
Valid	YEAH	15.4	20.0	20.0
	NO	61.5	80.0	100.0
	Total	76.9	100.0	
Lost	System	23.1		
Total		100.0		

Knowledge and mitigation of work stress work stress

Table 5 presents the results obtained from the processing of the responses to the closed question about knowledge and mitigation of work stress, carried out with quantitative analysis using descriptive statistics with the SPSS statistical program, which reflects the percentages of responses, valid and accumulated percentages.

Table 5

Frequency table for the question Do you know about AI tools applied in education?

		Percentage	Valid percentage	Cumulative percentage
Valid	YEAH	76.9	100.0	100.0
Lost	System	23.1		
Total		100.0		

Mitigation of work stress

Table 6 presents the results obtained from the processing of the responses to the closed question about mitigation of work stress, carried out with quantitative analysis using descriptive statistics with the SPSS statistical program, which reflects the percentages of responses, valid and accumulated percentages.

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Table 6

Frequency table for the question: Do you think that the use of AI reduces stress during the work day and would improve the quality of working life of teachers?

		Frequency	Valid percentage	Cumulative percentage
Valid	1	10	100.0	100.0
Lost	System	3		
Total		13		

Training and capacity building

Table 7 presents the results obtained from the processing of the responses to the closed question about training and capacity building, carried out with quantitative analysis using descriptive statistics with the SPSS statistical program, which reflects the percentages of responses, valid and accumulated percentages.

Table 7

Frequency table for the question Have you received specific training for the use of artificial intelligence tools in your workday?

		Percentage	Valid percentage	Cumulative percentage
Valid	YEAH	15.4	20.0	20.0
	NO	61.5	80.0	100.0
	Total	76.9	100.0	
Lost	System	23.1		
Total		100.0		

Contingency tables

Similarly, the data from the survey on the use of artificial intelligence in education was imported into the SPSS software. The variables were defined as nominal or ordinal, the toolbar was “Analyze”, “Descriptive Statistics”, “Crosstabs” was chosen, and the

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variables to be studied were chosen. Through which the results shown in Table 8 were obtained.

Table 8

Cross tables for training and education

Analysis	Total		
	Percentage	Percentage	Percentage
Have you received specific training for the use of artificial intelligence tools in your work day? * Work stress: Do you think that the use of AI reduces stress in the work day and would improve the quality of work life of teachers?	76.9%	23.1%	100.0%

Cross-tabulation (Table 9), training and capacity building: Have you received specific training for the use of artificial intelligence tools in your work day? And for work stress: Do you think that the use of AI reduces stress in the work day? Obtained through statistical analysis with the SPSS statistical program.

Table 9

Cross-tabulation of training and education

		Work stress: Do you think that the use of AI reduces stress during the work day and would improve the quality of work life for teachers?	Total
		YEAH	
Training and Capacity Building: Have you received specific training in the use of artificial intelligence tools in your workday?	YEAH	2	2
	NO	8	8
Total		10	10

Quantitative analysis using descriptive statistics with Python for open-ended survey questions

Since Python is a high-level, interpreted, general-purpose programming language, it was used to statistically analyze the open questions due to its clear and readable syntax

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(Python, 2024), which made it easy to write code, in addition to having a broad standard library and a robust ecosystem of packages and tools that extend its capabilities such as those required in this study.

First, the data to be analyzed was transcribed into a manageable structure in Python. Data coding and analysis was performed; that is, the main themes of the responses were extracted according to previous relevant bibliographic research and the frequencies of said themes in the responses provided by the surveyed teachers were analyzed. Below is a part of the code used.

Figure 1

Programming code in Python for extracting topics and frequencies using the "extract_topics" function

```
# Función para extraer temas y contar frecuencias
def extraer_temas(respuestas):
    temas = []
    for respuesta in respuestas:
        temas.extend(respuesta.split())
    return Counter(temas)

# Extraer temas de cada columna
temas_actividades = extraer_temas(df["Elección de actividades"])
temas_desafios = extraer_temas(df["Desafíos y cómo los ha superado"])
temas_estres = extraer_temas(df["Estrés laboral"])
```

The presented code snippet includes the "extract_themes" function, used to process responses and determine the most common themes. This Python function allows analyzing and quantifying the themes present in the data, providing valuable insights into the perceptions and experiences of study participants. On the other hand, the "extract_themes" function takes a list of responses as input and returns a "Counter" object containing the unique themes and their corresponding frequencies. An empty list called themes is created to store the extracted themes.

The programming code used for the analysis of this section of the survey applied to teachers was included in this scientific article because it was considered relevant. This code allows to quantify and analyze the most frequent themes in the responses of the participants, with the aim of obtaining valuable information about their perceptions and experiences related to the choice of activities, challenges and work stress. The results of this section are detailed in results and analysis.

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Results and discussion

For the closed-question survey, according to the inferential statistical analysis with SPSS, the following results are presented:

Table 10

Survey results analyzed using inferential statistics with SPSS

Spotlight analysis	Results
Popularity of AI educational tools	15.4% of teachers say they are aware of AI tools applied in education, while 61.5% have no knowledge of this. This shows the significant gap in popularity of AI assistance in teaching.
Knowledge of educational tools of AIs	76.9% of respondents are aware of AI tools applied in education. However, 23.1% of responses are missing, indicating that many teachers are aware of these tools, but the depth of knowledge is limited, as a large percentage do not feel well informed about them.
Training and Capacity Building in AI	Only 15.4% of respondents have received specific training for the use of AI tools. However, 61.5% have not received such training, indicating a significant need for training programs.
Mitigation of work stress	100% of teachers surveyed believe that the use of AI reduces work stress and improves the quality of work life.

In addition, the results of quantitative analysis using Descriptive Statistics with Python are presented for the open questions of the survey for:

Choosing AI to perform activities

Artificial intelligence educational tools are useful to teachers when their interface is in Spanish. This assistance is preferred for communication with students, parents, and lesson planning. As for pedagogical tools, teachers affirm that it helps in modifying and updating pedagogical inputs, and they also confirm that it facilitates time and class planning. Artificial intelligence assistance is considered an excellent aid by the teachers participating in this study.

*Challenges of**the**AI and overcoming*

Technical knowledge is a necessity that must be met in order to easily manipulate any AI platform. AI assistance could perform 80% of the requested work, but it must always be corrected and reviewed by the user/teacher, so it is assumed that the teacher must correct certain ambiguities. The biggest challenge found in the teachers' responses is a poor internet connection.

Reducing work stress with AI

AI reduced monotonous activities, allowing teachers to focus on improving the quality of education. It optimized teachers' time by simplifying repetitive and administrative tasks. In addition, AI improves time management in tasks such as lesson planning and evaluation. With the help of AI, it was possible to conduct more dynamic classes, freeing up time for other important activities. Finally, AI also reduces the intellectual effort required for certain tasks, facilitating a more efficient and effective educational environment around the quality of the teachers' work environment. Finally, once the data obtained was analyzed, it was possible to answer the following questions based on differential statistical analysis.

How can multiple AI tools be used to enhance teaching?

AI tools can be used to significantly improve teaching in several aspects. For example, they facilitate effective communication with students and parents, help improve time management, help optimize administrative tasks and in updating pedagogical resources, allowing teachers to dedicate more time to effective teaching and personalized attention to students and in carrying out evaluations, providing tools that can streamline and improve these processes.

What are the challenges that educators face when incorporating AI into their teaching tools?

One of the key challenges is the need to acquire adequate technical knowledge to effectively use AI platforms and insufficient technological infrastructure, such as poor internet connections, which can hinder the effective implementation of AI in the educational environment.

Should the state offer training on the use of AI in teaching?

It is crucial that the state provide specific training on the use of AI in teaching, given that this study reveals that the majority of the teachers surveyed lack formal training in these tools. Implementing these trainings would not only improve the technical competence of teachers, but could also elevate the quality of the education provided. This is due to improvements in time management facilitated by AI and a greater willingness to integrate these technologies into daily educational practice.

Can AI be used as a strategy to reduce teacher job stress?

According to the results of the study, 100% of the surveyed teachers are convinced that the use of AI can reduce work stress. Therefore, integrating AI appropriately and effectively can play a crucial role in improving the quality of teachers' working life by reducing workload and fostering a more dynamic and efficient educational environment.

Conclusions

- The integration of AI assistance in education shows significant potential for improving teaching work, as AI tools help to optimize teacher time management and facilitate administrative and pedagogical tasks and can allow for greater dedication to personalized teaching and the development of updated educational resources.
- Although AI is enjoying some popularity in education, it is clear that the lack of specific training and the need for adequate technical skills represent significant challenges for its effective adoption. It is essential that relevant government agencies invest in specific AI training programs for teachers, thus ensuring that they can take full advantage of these new technologies.
- A definite positive perception was found among teachers regarding AI's ability to mitigate work stress, which points to its potential as a tool to improve workplace wellbeing in education. By reducing monotonous tasks and simplifying administrative processes, AI not only frees up time for more meaningful activities, but also contributes to a more dynamic and satisfying work environment, benefiting both educators and students.

Conflict of interest

The authors declare that there is no conflict of interest in relation to the submitted article.

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