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ORIGINAL

Perception and use of ChatGPT among university students. Analysis based on K-Modes

Percepción y uso de ChatGPT entre estudiantes universitarios. Análisis basado en K-Modes

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ABSTRACT

The rapid advancement of artificial intelligence has transformed the educational landscape, with tools such as ChatGPT gaining popularity among university students. This study analyses the perception and use of ChatGPT in Ecuadorian higher education, exploring its impact on academic performance and associated ethical concerns. The objective was to examine how students from various universities and majors perceive the usefulness of ChatGPT in their academic activities. A non-probabilistic cross-sectional approach was employed, using a structured survey applied to 256 students from six Ecuadorian universities. The methodology included the use of the K-Modes algorithm to cluster the students' categorical responses, visualised through principal component analysis. The results revealed significant differences in the use of ChatGPT according to gender, university and career. Female and engineering students showed higher adoption. Four distinct groups of users were identified, reflecting diverse perceptions of the usefulness and risks of ChatGPT. The discussion addressed variability in ChatGPT adoption, highlighting factors such as technological access and ethical concerns. A tension was noted between perceived benefits and potential risks, such as over-reliance and plagiarism. In conclusion, the study highlights the importance of understanding students' perceptions of ChatGPT to effectively integrate these tools into higher education, while simultaneously addressing ethical concerns and encouraging responsible use of AI in academia.

Keywords: ChatGPT; Higher Education; K-Modes; Student Perceptions.

RESUMEN

El rápido avance de la inteligencia artificial ha transformado el panorama educativo, con herramientas como ChatGPT ganando popularidad entre los estudiantes universitarios. Este estudio analiza la percepción y el uso de ChatGPT en la educación superior ecuatoriana, explorando su impacto en el rendimiento académico y las preocupaciones éticas asociadas. El objetivo fue examinar cómo los estudiantes de diversas universidades y carreras perciben la utilidad de ChatGPT en sus actividades académicas. Se empleó un enfoque transversal no probabilístico mediante una encuesta estructurada aplicada a 256 estudiantes de seis universidades ecuatorianas. La metodología incluyó el uso del algoritmo K-Modes para agrupar las respuestas categóricas de los estudiantes, visualizadas mediante análisis de componentes principales. Los resultados revelaron diferencias significativas en el uso de ChatGPT según género, universidad y carrera. Las mujeres y los estudiantes de ingeniería mostraron una mayor adopción. Se identificaron cuatro grupos distintos de usuarios, que reflejan diversas percepciones sobre la utilidad y los riesgos de ChatGPT. La discusión abordó la variabilidad en la adopción de ChatGPT, destacando factores como el acceso tecnológico y las preocupaciones

éticas. Se observó una tensión entre los beneficios percibidos y los riesgos potenciales, como la dependencia excesiva y el plagio. En conclusión, el estudio destaca la importancia de comprender las percepciones de los estudiantes sobre ChatGPT para integrar eficazmente estas herramientas en la educación superior, al mismo tiempo que aborda las preocupaciones éticas y fomenta el uso responsable de la IA en el ámbito académico.

Palabras clave: Inteligencia; ChatGPT; Educación Superior; Modos K; Percepciones de los Estudiantes

INTRODUCTION

The rapid evolution of artificial intelligence (AI) has significantly transformed various aspects of everyday and academic life, especially access to information and ways of learning. One of the most prominent tools in this area is ChatGPT, an advanced language model developed by OpenAI that has gained popularity among university students due to its ability to generate coherent text and provide detailed responses based on the data it receives. The use of ChatGPT in the academic environment has generated both enthusiasm and concerns, prompting research into its impact on academic performance, its usefulness and the potential risks associated with its use.[1]

The present study focuses on analysing the perception and use of ChatGPT among university students, using an approach based on K-Modes analysis, a clustering technique mainly used for categorical variables. This method is suitable for identifying patterns and trends in non-numerical data, which makes it an ideal tool for analysing students' qualitative responses to their use and perception of ChatGPT.[2]

The increasing reliance on technology in education has opened up new opportunities and challenges for students and teachers. Artificial intelligence-assisted learning is an emerging trend that has gained prominence in higher education, particularly due to the increasing availability of tools such as ChatGPT. These tools not only allow quick access to information, but also facilitate the understanding of complex concepts, which can be of great help to students seeking support in difficult areas of their studies.[3]

However, the adoption of these technologies is not without its challenges. As students turn to tools such as ChatGPT to facilitate their learning and completion of assignments, concerns arise around the accuracy of the information provided, over-reliance on technology and potential associated risks such as plagiarism, lack of originality and possible violation of academic policies. In addition, there are concerns about the impact these tools may have on the development of critical skills, such as analytical thinking and the ability to solve problems independently.[4]

In this context, it is essential to understand how students perceive the use of ChatGPT. For many, ChatGPT represents a valuable tool that saves time and effort by providing quick and relevant responses to academic queries. In addition, many users appreciate the convenience that this technology offers, as it allows them to access information from anywhere and at any time. For others, the ease of use and the lack of need for advanced technical knowledge make it an accessible option to complement their studies.[5]

However, positive perceptions are not universal. Some students express concerns about the reliability of the information generated by ChatGPT, fearing that the tool does not always provide accurate or up-to-date data. Others fear that frequent use of ChatGPT may erode their critical thinking skills or lead to over-reliance on technology to perform tasks that should involve personal cognitive effort. These concerns are particularly relevant in academic environments where originality and analytical skills are critical to academic success.[6]

A central issue in the debate on the use of ChatGPT is its impact on academic performance. Several studies suggest that AI technologies can help improve academic performance by providing students with access to relevant and easy-to-understand information. In this regard, many students believe that ChatGPT has enabled them to improve their academic performance by making it easier to complete tasks and understand complex concepts that would otherwise be difficult to assimilate.[7]

On the other hand, there is also a latent concern among some students about the risk of relying too much on technology, which could lead to a lack of development of skills fundamental to their academic training. This fear is reflected in the fact that some ChatGPT users admit to having reservations about using it for assignments that require a high degree of originality or critical analysis, as they fear that relying too much on the tool could undermine their ability to produce original and well-founded work.[8]

The analysis of the perception and use of ChatGPT among students requires a methodology suitable for handling categorical responses. The K-Modes method is an extension of the K-Means algorithm, designed specifically for categorical variables. In this study, this method will be used to group students according to their responses to various questions related to the use of ChatGPT, such as whether they have used the tool, whether they find it useful, whether they recommend it to others, and what are their main concerns and perceived benefits.[9]

The use of K-Modes will allow us to identify patterns of use and perception among different groups of students, which will provide a clearer picture of how ChatGPT use relates to variables such as age, gender,

major and university. This approach will also allow us to assess whether there are significant differences in the perception of the tool according to the field of study, which could shed light on the areas in which ChatGPT is useful in the academic context. The main objective of this research is to explore how students from various universities and majors perceive the usefulness of ChatGPT in their academic activities and how their experience of use aligns with their expectations and concerns.

Related work

Since 2021, the use of artificial intelligence (AI) tools in education has been the subject of a growing number of studies analyzing both the benefits and challenges these technologies present for students. ChatGPT, as one of the most prominent natural language processing applications, has been the focus of several investigations focusing on its impact on learning, academic performance and students' perceptions of its usefulness and reliability. The following is a review of relevant studies on the use of ChatGPT in university education and how they have addressed key issues such as improved academic performance, student perceptions and the risks associated with the use of this technology.

A study published in 2023 investigated the impact of ChatGPT on the academic performance of university students in STEM (science, technology, engineering and mathematics) disciplines. The researchers conducted a comparative analysis between students who used ChatGPT for academic tasks and those who did not. The results indicated that students using ChatGPT showed significant improvement in understanding complex concepts and performing technical tasks, especially in topics related to programming and advanced mathematics. The study highlighted how ChatGPT facilitated problem solving and idea generation, which in turn led to better performance on exams and assignments.[8]

On the other hand, one study explored the use of ChatGPT in the humanities. In this case, literature and philosophy students who used ChatGPT in their assignments reported improving their understanding of complex theories and their ability to structure essays and arguments. However, this study also noted that while students appreciated the writing support and access to quick information, some feared that over-reliance on ChatGPT could affect their ability to develop critical thinking skills and independent analysis.[10]

Another widely researched aspect is students' perception of ChatGPT and its role in academic support. A study by[11] addressed how students perceived the usability and effectiveness of ChatGPT in higher education. In this study, students from various disciplines stated that ChatGPT was an easy-to-use tool and that it helped them save time by providing quick answers to questions and queries related to their studies. In addition, many students found ChatGPT to be a reliable source of information, although some had concerns about the accuracy of responses on more specialized topics.

A study by[12] also examined the perceived accuracy and reliability of ChatGPT among social science students. The results revealed that students tended to find ChatGPT a useful source for general information but were more cautious about relying on the tool for more specific or complex topics. Singh and Patel concluded that while ChatGPT is valued for its speed and accessibility, confidence in the quality of responses may vary depending on the level of complexity of the questions.

In addition to studies on the usefulness of ChatGPT, attention has also been paid to the risks and concerns surrounding its use. A recent study investigated the potential risks associated with the use of ChatGPT, particularly in terms of plagiarism, originality and violation of academic policies. The authors found that, although students recognise the benefits of using ChatGPT, many of them expressed concerns that overuse of the tool could lead to a dependency that could compromise their ability to develop original ideas and avoid unintentional plagiarism. The study also highlighted concerns about privacy and data security that some students expressed when using this technology, which poses additional challenges for academic institutions seeking to integrate these tools into learning without compromising academic integrity.[13]

Similarly, they addressed concerns about the possible lack of critical thinking development among students who frequently use ChatGPT. In their study, the authors concluded that, although ChatGPT can serve as a support tool for understanding difficult concepts, the constant use of this technology could reduce students' intellectual autonomy when solving complex problems. According to the authors, it is essential to find a balance between the use of artificial intelligence tools and the development of critical cognitive skills, so that students do not become passive users of the technology.[14]

Some studies have compared ChatGPT with other AI tools available in academia. For example, a study was conducted that compared ChatGPT with other AI-based virtual assistants, such as Google Assistant and Siri, in terms of effectiveness and user satisfaction. The results showed that ChatGPT was perceived as a more versatile and accurate tool compared to other AI systems, especially in academic tasks. Students indicated that ChatGPT provided them with more detailed and useful answers for university assignments, while other assistants were more limited in their ability to answer complex or contextually specific questions.[15]

Recent research suggests that the use of tools such as ChatGPT will continue to expand in higher education, with a growing interest in integrating artificial intelligence into curricula more formally. One study highlights

the importance of training students and teachers in the proper use of AI tools, so that they can maximize their benefits without compromising ethical and academic principles.[16]

METHOD

The present study was carried out with a non-probabilistic cross-sectional approach, with the aim of analyzing the perception and use of ChatGPT among university students in Ecuador. Students were selected from six universities in different regions of the country, covering both public and private universities. The cross-sectional design allowed for the collection of data at a single point in time, which facilitates the identification of current patterns and trends in the use of this technology within the student community.[17]

The sample consisted of a total of 256 students from six Ecuadorian universities. Undergraduate students were included, belonging to different degree programs, including social sciences, humanities, health sciences, engineering and technology. Inclusion criteria required students to be actively enrolled and to have used ChatGPT at least once in the context of their academic activities. Sampling was non-probability convenience sampling, meaning that participants were selected based on their accessibility and availability to respond to the survey. Despite the inherent limitations of this type of sampling, it was considered adequate to gain a preliminary insight into students' perceptions and experiences of using ChatGPT.[18]

A structured survey was used for data collection, previously validated in a study published by renowned authors in the field of educational research. The questionnaire included socio-demographic variables such as age, gender, university and career, as well as a series of specific questions about the use of ChatGPT and the students' perception of this tool. Questions related to the perception and use of ChatGPT included items measuring frequency of ChatGPT use, perception of the usefulness of ChatGPT in saving time, improving academic performance and facilitating understanding of difficult topics. Concerns related to reliability of information, plagiarism, dependence on technology and data security. Responses were collected using a 5-point Likert scale, where students indicated their level of agreement or disagreement with key statements about ChatGPT.[19]

The survey was distributed virtually via online forms to facilitate access to students from different universities and ensure greater participation. Participants were provided with a detailed explanation of the purpose of the study, and the confidentiality and anonymity of responses was ensured. In addition, informed consent was sought from all students before the survey began.

For data analysis, Python statistical software was used, using the Google Colab collaborative environment. The main statistical technique was the K-Modes algorithm, a clustering method specifically designed to handle categorical variables. This technique was selected due to the qualitative nature of most of the variables in the study, such as students' perceptions and opinions about ChatGPT.[20]

The study complied with ethical standards for human research. Informed consent was obtained from the participants, who were informed about the voluntary nature of their participation and their right to withdraw from the study at any time. Data were treated confidentially and anonymized to protect the identity of the students.[21]

RESULTS AND DISCUSSION

This section presents the experimental results and analysis of the study, which aims to understand the perception and use of ChatGPT among university students. Through the application of the K-Modes algorithm, common patterns of perception are identified, and students are grouped according to their responses in relation to the usefulness, reliability and ease of use of this tool. The analysis also explores how students rate the efficiency of ChatGPT in terms of time savings and support in understanding academic topics, while examining their concerns regarding possible dependence on technology, accuracy of the information provided, and ethical and academic risks.

Table 1. Use and perception of ChatGPT

Variables	Category	NO (%)	YES (%)
Sex	Female	19,14	35,94
	Male	17,19	27,73
University	Chimborazo Polytechnic High School	11,72	21,88
	State University Of Milagro	16,8	28,91
	Intercultural University Of Nationalities And Indigenous Peoples Amawtay Wasi	2,73	1,56
	National University Of Chimborazo	0,78	6,64

	Technical University Of Ambato	3,52	0,78
	Technical University Of Cotopaxi	0,78	3,91
Career	Engineering	25	50
	Degree	5,47	4,3
	Health	5,86	9,38

The results obtained reflect a marked differentiation in the use of ChatGPT between genders and participating universities. In terms of gender, women (35,94 %) use ChatGPT more than men (27,73 %), which is in line with previous studies that have pointed to an increasing adoption of technologies by women in academia.[22] This behaviour suggests a greater integration of technological tools in women's academic activities, possibly due to their perceived usefulness in terms of support and time savings in complex tasks.[23]

In the analysis by universities, it stands out that students at the State University of Milagro (28,91 %) and the Polytechnic School of Chimborazo (21,88 %) are the ones who use ChatGPT the most, while in smaller or interculturally oriented institutions, such as the Intercultural University Amawtay Wasi, the use is significantly lower (1,56 %). This may be related to factors such as the availability of technological resources and awareness of the potential of artificial intelligence tools, as well as the technological infrastructure that these universities offer.

The use of ChatGPT is predominantly higher among engineering students (50 %), in contrast to health (9,38 %) and undergraduates (4,30 %). This is in line with research highlighting that students in technical careers tend to adopt advanced technologies such as ChatGPT more quickly, given their focus on problem solving and finding technical solutions. Engineering students find ChatGPT an effective tool for simplifying complex tasks such as programming and data analysis, while in careers such as healthcare, where clinical reasoning and human interactions are critical, its use is more limited. Analysis of the data reveals interesting patterns of ChatGPT usage and perception among university students at various institutions. In this context, the use of the K-Modes algorithm allowed us to identify four groups or clusters that reflect similar behaviors and attitudes among participants, based on socio-demographic variables and their opinions about ChatGPT, which is crucial for the design of educational strategies that effectively integrate these tools into the curriculum.[24,25]

A relevant aspect is the difference in the use of ChatGPT according to gender. The analysis indicates that women tend to use this tool more than men, which is consistent with previous research. Women in academia tend to adopt technologies that allow them to optimize time, which explains their greater affinity with ChatGPT. This could be related to the perception of the tool as an effective means of managing academic responsibilities in a limited amount of time.[26]

In contrast, men, although also users of the technology, have lower adoption, which may be influenced by their distrust of the reliability of the information provided by ChatGPT or concerns about developing critical skills. These concerns have been noted in studies on the use of artificial intelligence in higher education, suggesting that men may be more cautious in their interaction with tools such as ChatGPT.[26]

Among the participating universities, students at the Universidad Estatal de Milagro and the Escuela Superior Politécnica de Chimborazo are the most likely to use ChatGPT, compared to students at institutions with less technological infrastructure, such as the Universidad Intercultural Amawtay Wasi. These results are consistent with studies that claim that access to technology and familiarity with artificial intelligence tools vary according to institutional context. Universities with more technological resources tend to promote greater use of digital tools, which reinforces the hypothesis that the educational environment plays an important role in the adoption of ChatGPT.

The use of ChatGPT is significantly higher among engineering students (50 %), which is consistent with previous studies suggesting that students in technical disciplines are more likely to adopt new technologies. Engineering students find ChatGPT an ally to simplify complex tasks, such as programming and mathematical problem solving, which explains their high adoption rate. In contrast, students in health (9,38 %) and undergraduate (4,30 %) disciplines show a more limited use, probably due to the human and contextual nature of their disciplines, which rely more on interaction and critical reasoning than on automated solutions.[27]

In terms of perceptions of ChatGPT's usefulness, the data shows that many students find that the tool helps them save time and facilitate understanding of difficult topics. This finding is consistent with studies indicating that students who adopt artificial intelligence technologies tend to value them for their ability to simplify access to information and the resolution of academic tasks. However, some students, mainly in health careers, expressed concerns about the accuracy and reliability of the information provided. Another important aspect is the concern about plagiarism and over-reliance on technology, recurring themes in the discussion about the use of ChatGPT. Some students expressed fears that frequent use may affect their development of critical skills and their ability to perform tasks in an original way, which is consistent with warnings about the risk of over-reliance

on artificial intelligence tools. Concerns about privacy and data security were also found to be low, which may indicate a lack of awareness of these risks among students.[12,12,28,29]

The use of ChatGPT varies significantly by gender, university and career, suggesting that institutional, technical and disciplinary factors influence the adoption of this tool in academia. The graph presented is a visualization of the clusters obtained using the K-Modes algorithm. The graph uses principal component analysis (PCA) to project the high-dimensional data into two principal components, with the aim of visually showing how the data are grouped according to their categorical similarities.[30]

The graph presents four distinct clusters, identified by the colors red, blue, green and purple (figure 1). These clusters are based on the grouping of responses from students from different universities in relation to their use and perception of ChatGPT. The number of clusters is consistent with the previously selected partitioning method, which is typical for studies applying K-Modes, an algorithm designed for categorical data, as noted by[31].

Each cluster has a representative centroid reflecting the modal mean of the selected categorical variables.

- Cluster 0 (red) shows a dense concentration of dots, indicating that this group of students has relatively homogeneous responses. This could represent students who use ChatGPT frequently and have similar perceptions of its usefulness.
- Cluster 1 (blue) and cluster 2 (green) are more dispersed and show higher variability in the second principal component. The dispersion in these clusters suggests that these students have more diverse opinions, possibly torn between regular use of the tool and concerns related to its reliability or ethical use. This phenomenon has been addressed in previous studies analysing the perception of artificial intelligence technologies, where the coexistence of positive ratings and ethical concerns among users is highlighted.[16]
- Cluster 3 (purple) is more compact than the blue and green groups, but still shows significant dispersion. This could suggest students who have moderate perceptions and uses of ChatGPT, perhaps finding a balance between the perceived advantages and the concerns mentioned.

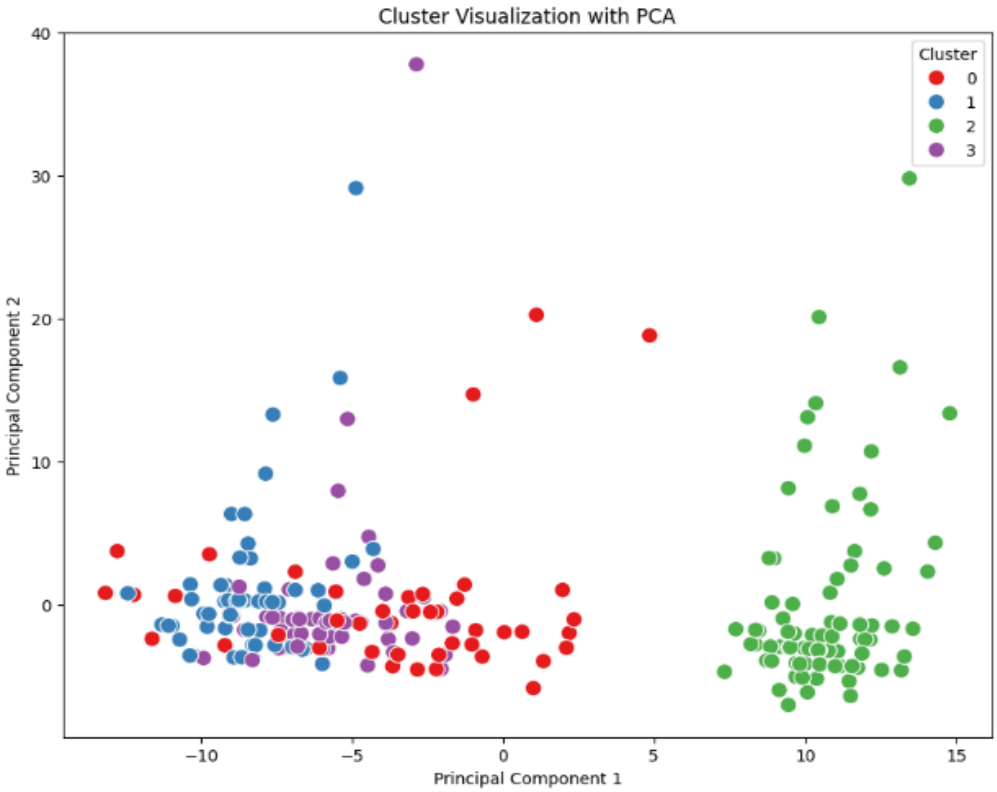

Figure 1. Centroids K-Modes

The K-Modes algorithm groups students based on categorical responses, such as use of ChatGPT in academic activities, perceived trustworthiness and ethical concerns. The use of the PCA allows us to observe how students are grouped based on similarities in these responses. In this context, the grouping allows the following relevant findings to be inferred:

1. Cluster 0 (red) is composed of students who appear to be the most homogeneous, suggesting a widespread acceptance of ChatGPT use without major concerns about its impact. This trend is consistent with research indicating that students at universities with greater access to technology tend

to adopt these tools more quickly and without as many ethical reservations.[4]

2. Cluster 2 (green) and cluster 1 (blue) show a dispersion indicating greater variability in students' perceptions. Some of them may use ChatGPT on a regular basis, but at the same time express concerns about the reliability of the information or the risks of relying too much on the technology. This finding is consistent with studies that reveal ambivalence towards the use of artificial intelligence technologies among students, who recognize both their advantages and risks.[32,33]

3. Cluster 3 (purple) presents a compact group suggesting a moderate perception of ChatGPT. Students in this cluster may use the tool, but they do so with some caution, possibly concerned about lack of originality in their assignments or plagiarism. This behavior is consistent with observations that highlight that students in humanities or social science disciplines tend to have more reservations about using technologies that may compromise the originality of their ideas.[34,35]

The use of the K-Modes algorithm is particularly suitable for this type of analysis due to the categorical nature of the variables analyzed. This algorithm facilitates the grouping of students into similar categories without the need to convert categorical variables into numerical ones, which could distort the results. The graph shows that the algorithm was able to identify consistent groups of students with similar perceptions of ChatGPT use, suggesting that these perceptions are influenced by demographic and contextual factors.

CONCLUSION

The use of AI tools such as ChatGPT is changing the educational landscape by providing fast and efficient access to information. However, the adoption of these technologies poses both benefits and risks. Through a detailed analysis based on K-Modes, this study seeks to better understand how university students perceive and use ChatGPT, identifying the main factors influencing their experience and the remaining concerns about its impact on academic performance and critical skills development.

The analysis reveals that the adoption and perception of ChatGPT varies considerably by gender, university and career. Female students, as well as those in technical careers, tend to be more likely to adopt this tool, while in more humanistic careers and in contexts with less technological access, use is more limited. Perceptions of the reliability, usefulness and risks of using ChatGPT reflect both potential benefits and ethical concerns, underlining the importance of addressing these issues in higher education.

The analysis of the graph suggests that students have diverse perceptions about the use of ChatGPT, influenced by both their academic context and their ethical concerns. The grouping into four clusters allows us to identify patterns of use and perceptions, where cluster 0 stands out as the most homogenous and positive towards the tool, while the other groups show greater variability and concerns reflecting the complexity of the impact of AI in academia. This analysis is consistent with previous research on the acceptance and ethical concerns related to the use of emerging technologies in education.

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