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The Application of Artificial Intelligence in Brazilian Distance Education

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Abstract: *This article presents an integrative review on the use of artificial intelligence in the Brazilian educational context. The research analyzed publications from the Brazilian Journal of in Education from the years 2023 and 2024, with the aim of identifying the applications and techniques of artificial intelligence used in education. The methodology involved identifying the theme, establishing a protocol for literature review, categorizing the studies, and synthesizing knowledge. It was found that the most used techniques in the educational context are computer vision, machine learning, data mining, and natural language processing. The impacted areas of education were teaching-learning and school administration/management. There is a need for further research on applications in the context of school administration, as well as potential exploration of more classroom applications and ethical debates surrounding the use of artificial intelligence.*
Keywords: *artificial intelligence in education; ethics, literature review*

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I. Introduction

The proliferation of artificial intelligence (AI) in society is advancing swiftly, impacting both groups and people (Almeida, Mendes & Doneda, 2023). Numerous authors have endeavored to delineate the concept of AI. According to McCarthy (2007), it is a domain of knowledge and technological advancement focused on the creation of intelligent machines, particularly sophisticated software systems. Russell and Norvig (2010) classify the diverse definitions of AI put out by different authors throughout history into four fundamental approaches: systems that emulate human behavior; systems that replicate human cognition; systems that engage in rational thought; and systems that exhibit rational behavior.

Artificial intelligence has several applications. Santos (2024) illustrates this through a literature analysis that delineates its application in health, industry, services, and education.

The integration of technology in education is deemed contentious due to the diverse interests and objectives involved (Durso, 2024). The obstacles to integrating technology in education are numerous, and artificial intelligence is no exception. The ongoing issue of inadequate infrastructure in educational institutions hampers the provision of essential tools for educators and learners, compounded by insufficient training for faculty and technical staff in the utilization and support of these technologies (Machado & Santos, 2024). Notwithstanding these challenges, Müller, Bergande, and Brune (2018) contend that the application of artificial intelligence in education has been extensively deliberated. Despite the constraints of contemporary learning contexts, AI in education ought to be regarded as a supplementary resource for educators, aimed at improving the quality of their efforts.

With the growing availability of diverse AI solutions inside the educational landscape, numerous inquiries emerge: What is the present application of AI resources in education? What tools and technologies are being utilized? For what objectives? Are there ethical considerations about data utilization in the application and development of artificial intelligence? This research analyzes recent publications in computer science education, concentrating solely on the Revista Brasileira de Informática na Educação (RBIE), a journal

published by the Special Commission on Informatics in Education of the Brazilian Computer Society (SBC), in collaboration with national and international researchers and universities. The magazine aims to disseminate research conducted by scholars and practitioners in educational informatics, advancing methodologies, practices, and instruments that enhance the efficient integration of technology in pedagogy and learning (RBIE, c2024).

This study seeks to provide an integrative literature analysis of publications that focus on the application of artificial intelligence within the Brazilian educational framework. The investigation concentrates on publications published in the RBIE in 2023 and 2024. The study's specific objectives are: a) To analyze discussions concerning the application of artificial intelligence in education as articulated in RBIE articles; b) To identify the AI tools and technologies utilized in education according to RBIE publications; c) To delineate, based on the selected RBIE articles, the educational domains that have integrated artificial intelligence; and d) To present the findings and limitations of the research.

II. Literature Review

The article provides an integrated literature evaluation, including data gathered via a bibliographic survey in the Revista Brasileira de Informática na Educação (RBIE). The data collection was conducted manually, concentrating on article titles that reference "artificial intelligence" or associated terminology.

The integrated review serves as a methodological instrument for organizing scientific information. This technique facilitates fresh research opportunities by analyzing existing evidence. This review facilitates the assessment of works utilizing several methodologies, including both qualitative and quantitative approaches (Botelho, Cunha & Macedo, 2011).

Subsequent to data collection, a thorough evaluation of the studies and a meticulous interpretation of the findings are required. This technique facilitates the identification of research deficiencies and the delineation of themes for consideration in further studies (Botelho, Cunha & Macedo, 2011).

The stages for developing this integrative review adhered to the framework established by Botelho, Cunha, and Macedo (2011), specifically: a) Identification of the topic and formulation of the research question; b) Establishment of inclusion and exclusion criteria; c) Identification of the identified studies; d) Categorization of the selected studies; e) Analysis and interpretation of results; and f) Presentation of the review and synthesis of knowledge.

The core inquiry of this integrative literature evaluation was: “In what ways are artificial intelligence resources utilized within the educational framework?” From this primary inquiry, the subsequent derived questions were formulated to direct the research: What artificial intelligence techniques and technologies are utilized in the educational sector? In which domains of education has artificial intelligence been implemented? Are there ethical considerations with the data utilized in the development of artificial intelligence models?

III. Methology

The data collection happened from April to May 2024, concentrating on articles published in the Revista Brasileira de Informática na Educação (RBIE). The selection period for articles encompassed publications from January 2023 to March 2024, considering the introduction of ChatGPT in November 2022 (OpenAI, 2022) and the notable increase in topic-related searches commencing in 2023 (Google Trends, 2024). The preliminary selection of papers was conducted manually by scrutinizing the titles of each paper published in Volumes 31 and 32 of the magazine. The objective at this stage was to ascertain if the terminology employed in the titles pertained to artificial intelligence. The subsequent terms were evaluated for article selection: data mining, learning analytics, automatic classification, machine learning, intelligent systems, intelligent tutoring, neural networks, automatic evaluation, personalized recommendation, estimation, automatic adaptation, artificial intelligence, and prediction.

The subsequent information was gathered from each chosen article: Title: Author(s); Year of Publication; AI Methodology Employed; Application of Artificial Intelligence; and Discussion of Ethical Considerations.

Article Selection Procedure

This section delineates the phases involved in the article selection process. The initial phase of data gathering entailed reviewing the titles of all publications in RBIE from 2023 and 2024. From a total of 65 publications, the title analysis identified 18 articles.

The subsequent stage was reviewing the abstracts to discern papers that were systematic reviews, which were then eliminated from the dataset. Subsequent to this filtration phase, 12 publications persisted.

The chosen publications were subsequently downloaded and placed in a shared Google Drive repository to enhance accessibility for the scholars. A technical analysis of the articles was subsequently performed to implement the remaining inclusion and exclusion criteria. This analytical phase sought to uncover research that

demonstrated a direct correlation with education, indicating that the implementation of AI techniques exerted a direct impact on the educational environment—either in the classroom or in educational management/administration. Nine publications were thoroughly evaluated and incorporated into this integrative review following the application of these criteria. Table 1 delineates the procedures for article selection.

Table 1 – Steps for Article Selection

Step	Number of Articles After Each Step
Initial Collection	18
Abstract Analysis	12
Technical Reading	9

Source: Author (2024)

The publications were reviewed and summarized individually to collect information pertinent to the guiding issues of this study. A numbered list was generated to enhance visualization, including each article's title, authorship, and publication year, succeeded by Table 2, which displays the extracted data.

1. "Detection of Learning Emotions through Facial Recognition: An Approach Based on Deep Neural Networks and Emotion Flow," by Werlang and Jaques (2023);
2. "Mining Data to Understand the Factors Influencing Educational Quality in Maranh√£o," by Soares et al. (2023);
3. "A Personalized Recommendation Approach for Educational Materials through Content-Based Filtering in Virtual Learning Environments," by Pereira J√ínior, Ara√újo, and Dor√ßa (2023);
4. "Automatic Content Adaptation Applied to an Interactive Individualized Learning Environment," by Peronaglio et al. (2023);
5. "Educational Experience Report Using Image-Synthesizing Artificial Intelligences: Discussion on Recent Advances and Possibilities in Creative Synthesis," by Russo, Sant'Anna, and Imai (2023);
6. "A Detailed Analysis of Learning Performance in Teaching Machine Learning in Basic Education Using Item Response Theory," by Rauber et al. (2023);
7. "Automatic Classification of Learning Material Styles," by Aquino, Souza, and Barr√©re (2023);
8. "Dropout Prediction Model Based on Self-Assessment Data from Undergraduate Courses," by Oliveira and Medeiros (2024);
9. "Transformers for Predicting Academic Performance in Elementary and Secondary Education," by Rodrigues et al. (2024).

Table 2 – Data Extracted from Selected Studies

#	**AI Techniques**	**AI Applications**	**Addresses Ethical Issues?**
1	Computer Vision, Machine Learning	Emotion Detection for Pedagogical Intervention	Yes
2	Data Mining, Machine Learning	Educational Management and Administration	No
3	Machine Learning	Recommendation of Learning Objects	Yes
4	Natural Language Processing	Intelligent Tutoring Systems	No
5	Machine Learning	Image Synthesis	No
6	Machine Learning	Learning Assessment	Yes
7	Machine Learning	Automatic Classification of Educational Videos	No
8	Machine Learning, Data Mining	Prediction of School Dropout	No
9	Machine Learning	Prediction of Academic Performance	No

Source: Author (2020).

IV. ANALYSIS AND DISCUSSION OF RESULTS

A conclusion section must be included and should indicate clearly the advantages, limitations, and possible applications of the paper. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extentions.

This section aims to present the studies chosen for this review and to address the questions that directed

the research's growth.

Presentation of the Research

This subsection provides a synopsis of each study examined in the literature review. Werlang and Jaques (2023) conduct research to employ artificial intelligence for the detection and classification of students' emotions, intending to utilize this affective data to comprehend students' challenges, tailor pedagogical interventions, and enhance engagement. The research utilizes artificial intelligence to identify and categorize students' emotions during the viewing of instructional material, aiming to tailor pedagogical interventions and enhance student engagement.

The research examines four emotions associated with learning: engagement, bewilderment, boredom, and irritation. Convolutional and recurrent neural networks, including complementing data like eye movement and head position, were employed for the automatic detection of emotions in films. Three distinct databases were utilized for the training and assessment of the models. DAiSEE comprises footage of individuals in diverse scenarios, annotated with emotional states and intensity levels. The second dataset, EmotiW 2018, comprises videos of students viewing educational films, annotated for involvement. The third database was acquired from local experiments with students utilizing a learning system (Werlang & Jaques, 2023).

The preprocessing entailed dividing the videos into two-second parts and extracting five frames per second to minimize the data volume. Two neural networks were employed for model training: one that analyzed characteristics derived from the movies and another that processed supplementary features. The assessment was conducted utilizing criteria including precision, recall, and F1-score. The integration of the two networks enhanced the detection of learning-related emotions, underscoring the significance of including both spatial and temporal data in students' facial expressions.

Emotion recognition was automated using recorded footage of students' facial expressions during their engagement with learning settings, obtained by devices like webcams. Emotion identification in movies entails utilizing techniques to extract facial information and develop an emotion classifier. This classifier considers both the sequence of pictures in the video and the chronological order of the emotions conveyed by pupils.

The rising prevalence of intelligent learning environments has intensified interest in using students' emotions to improve their educational experience. The scientists intend to enhance this method by gathering additional data and training models with culturally diverse faces, alongside creating specialized models for emotions including perplexity, annoyance, and boredom. Formulating a model for involvement was notably difficult, and constructing tailored models for other emotions could result in substantial enhancements owing to the unique attributes of these emotions within the educational framework.

Soares et al. (2023) employ data mining and machine learning methodologies to ascertain the elements that affect the quality of public education in Maranhão. The statistics from 2019 were sourced from the Basic Education Development Index (IDEB) and the Basic Education Assessment System (SAEB) databases, both supplied by the National Institute for Educational Studies and Research Anísio Teixeira (INEP). The research exclusively examined data from public high schools.

The data analysis revealed that educational institutions in the metropolitan area of the state capital exhibit superior educational indicators, with schools in the capital attaining IDEB scores above the average, whilst rural schools score below the average. A notable variance was seen throughout the state's microregions, where it was not feasible to identify one or more variables that uniformly affect IDEB scores throughout the state.

The linear regression machine learning system successfully predicted a city's IDEB score based on its Municipal Human Development Index (MHDI) within an acceptable margin of error. The Orange Data Mining technique, utilizing decision trees, determined that “Parents’ Education Level” and “Technology” are the most significant variables affecting students’ average IDEB results.

Soares et al. (2023) employ artificial intelligence methodologies inside educational administration and management to ascertain aspects influencing educational quality in Maranhão. This exemplifies a significant application of AI, offering insights that can aid in public policy formulation to tackle educational challenges. The analysis is ethically grounded in data exclusively sourced from official entities, indicating the absence of any discernible legal concerns. Nonetheless, the authors fail to contemplate the implications of data processing for AI model training or the accompanying potential hazards.

The study conducted by Pereira Júnior, Araújo, and Dorça (2023) examines the retrieval and organization of web materials as Learning Objects (LOs) for recommendation in Virtual Learning Environments (VLEs). The primary inquiries focus on the viability of organizing web materials as Learning Objects (LOs), the advantages of automated recommendations tailored to students' knowledge levels and learning styles, and the preservation of the relevance of web-generated LOs.

A recommender system for educational materials in LO format was created, utilizing artificial intelligence (semantic web technologies and a bio-inspired algorithm) to provide individualized

recommendations via content-based filtering (CBF) integrated with pedagogical theories. The methodology encompassed seven phases, utilizing data from both students and educators, and depended on an ontology for metadata storage. Students undertook an optional Index of Learning Styles (ILS) questionnaire to ascertain their learning styles, while data from teachers were utilized to develop the learning objectives (LOs).

The research concentrated on organizing resources from YouTube and Wikipedia, as these platforms offer APIs that facilitate information extraction. The selection of Learning Objectives (LOs) was predicated on student demand, with the optimal LOs identified by a bio-inspired algorithm designed to address the Set Covering Problem (SCP). The methodology was executed and evaluated in Moodle, showcasing the efficacy of tailored recommendations.

The study identified several limitations, including frequent API upgrades, YouTube search limits, and issues provided by the COVID-19 epidemic, which led to remote testing and diminished student involvement. The study emphasized the necessity of creating technologies that offer enhanced feedback to educators concerning student conduct in virtual learning environments (VLEs).

Peronaglio et al. (2023) provide a model that employs artificial intelligence (AI) and natural language processing (NLP) techniques to tailor original information to one of the four learning styles identified by Kolb (1976, as quoted in Peronaglio et al., 2023, p. 262).

The author asserts that the unique characteristic of this approach is its capacity to produce variations of the input text, modifying it in numerous ways autonomously. These versions are developed by taking into account learning styles, enabling the content to be delivered in accordance with particular pedagogical methods and learning profiles, facilitating their integration into intelligent tutoring systems. The authors state their intention to utilize AI and NLP approaches but refrain from providing specifics, as the publication discusses a current study. The utilization of AI is intrinsically linked to education, as the product produced by the model will be employed by students.

The work fails to disclose the source of the data intended for use in AI processes from an ethical perspective. Considering that the publication addresses intelligent tutoring systems, it is essential to contemplate both the training data and the input data utilized by the model. Given that the end users are students, meticulous attention to data gathering and processing methodologies is essential.

The study by Russo, Sant'Anna, and Imai (2023) examined creative synthesis through image-generating artificial intelligences (AIs), emphasizing tools like Midjourney, Craiyon, Dream, and DALL-E. The research was conducted as part of an interactive online debate with students from a technical high school, focusing on inclusive and high-quality education. The primary aim was to demonstrate recent progress in image-generating AI technology and emphasize its instructional significance.

The authors highlighted the significance of multiliteracy, computational thinking, and AI literacy in modern education, intending to equip students to critically engage with machine learning algorithms and AI-generated digital media. The study aimed to enhance scientific dissemination via educational experiences, engaging students in interactive discussions on artificial intelligence.

The authors indicated that the methodological approach was exploratory and experimental, grounded in the ideas of pedagogical opportunism and connectivism. The research examined the innovative interaction between the participants' imagination and the imagination model of image-generating artificial intelligences. The findings demonstrated that the interaction between participants and AI facilitated an experiential education, marked by a dynamic, reflexive, and critical developmental process. This methodology diverges from conventional educational paradigms by fostering ongoing exploration of lived experiences and facilitating the actual use of gained knowledge, hence enhancing scientific dissemination and discussions around AI-generated digital media.

Rauber et al. (2023) delineate the design, development, and implementation of a learning assessment paradigm for machine learning (ML) in primary education. The course, entitled "ML for Everyone!", was designed to familiarize elementary and high school pupils with machine learning concepts, specifically focusing on picture classification through artificial neural networks. For image categorization, the researchers utilized the Google Teachable Machine (GTM), a tool created by Google that enables users to train machine learning models interactively without the necessity of coding.

The authors indicated that student learning was evaluated using a rubric, an assessment tool that gauges student performance based on the application of ML ideas. The research was exploratory, utilizing case studies, with data collected from five course iterations conducted between 2021 and 2022, encompassing a total of 108 students.

The rubric analysis utilized Item Response Theory (IRT), producing favorable outcomes that demonstrated the rubric's reliability and validity as an assessment tool for ML learning in primary education. According to Cappelleri et al. (2014, as quoted in Rauber et al., 2023, p. 1035), Item Response Theory (IRT) is "a collection of measurement models that aim to elucidate the relationships between observed item responses and an underlying latent construct." The study examines the dimensionality analysis and parameter calibration

of Item Response Theory (IRT), assessing students' performance based on artifacts produced throughout the learning process.

This resulted in the preliminary establishment of a scale to assess students' learning levels, wherein the research investigated the correlation between various IRT components and the evaluation of students' performance based on their practical outputs. The findings suggest that the rubric for assessing machine learning is nearing complete reliability and validity as a tool for evaluating students' proficiency in constructing machine learning models for image classification using GTM in secondary computer science education.

The research conducted by Aquino, Souza, and Barrére (2023) sought to establish a comprehensive model for categorizing video lecture styles and to provide a method for the automated classification of educational films based on these styles. The authors performed a systematic literature study to categorize video lectures into four types: Talking Head, Voice Over Slides, Presentation Style, and Khan Style.

The dataset utilized for automatic categorization comprised educational films from diverse sources, amounting to 40.39 hours of content for model training. Various video processing techniques were employed to extract information from the movies, including the detection of individuals and the extraction of textual material. Various classification techniques were assessed, with Logistic Regression attaining the highest performance at 92% accuracy.

The article discusses an artificial intelligence program designed for students and educators to select instructive movies in various styles. The research utilized movies licensed under Creative Commons, permitting non-commercial use; yet, it lacks any ethical consideration for the employment of such data for training AI models.

Oliveira and Medeiros (2024) conducted research to develop and validate a predictive model for identifying students at risk of dropout, utilizing semiannual self-assessments from undergraduate programs at the Federal University of Paraíba (UFPB). The phenomenon of school dropout poses a persistent challenge for educational institutions; in higher education, elevated dropout rates result in economic detriment and a deficiency of educated professionals in the labor market.

The research investigated the correlation between school dropout rates and institutional self-evaluation. The authors utilized an Educational Data Mining (EDM) process and machine learning techniques to extract knowledge from educational datasets in order to accomplish their aims. The research was executed in six phases: comprehending the domain, analyzing educational data, preparing data for mining, modeling, evaluating models, and applying the educational solution.

During data preparation, many procedures were executed to provide an appropriate subset for modeling, including filtering, variable elimination, removal of missing values and outliers, variable transformations, and mean computations. The analysis encompassed 1,156,891 records from self-assessments of on-campus undergraduate programs.

The study evaluated various classification methods for forecasting dropout rates. Upon assessing performance criteria including accuracy, precision, recall, and F-measure, the Random Forest-based technique with SMOTE data balancing produced the most favorable outcomes.

The model was utilized on data from active students' self-assessments, and the outcomes corresponded with the state's existing dropout metrics, taking into account the ratio of admissions to graduates within the same academic year. The primary outcomes suggest that dropout can be predicted generically and with commendable accuracy via self-assessment data. Nonetheless, the model exhibited suboptimal performance for students who enrolled prior to 2017, perhaps attributable to the absence of data regarding earlier coursework.

Oliveira and Medeiros (2024) identified novel problems and potential for future research on dropout prediction. It is crucial to examine the impact of certain subjects on dropout rates, to evaluate the efficacy of course-specific models in comparison to generic models, and to incorporate socioeconomic and academic data to improve predictive accuracy.

Rodrigues et al. (2024) propose employing deep learning neural networks, particularly the transformer architecture, to forecast academic achievement in primary and secondary school. The impetus arose from an absence of research utilizing machine learning for predicting academic success in primary school. The primary research question was: “Does the application of deep learning utilizing the transformer architecture confer advantages in predicting academic performance from semi-structured data pertaining to elementary and high school students?” 2. "At what point in the academic term does this advantage become substantial?"

To facilitate comparison, the authors further employed Gradient Boosting (XGBoost) and a feedforward neural network featuring a more straightforward deep learning architecture. The dataset included evaluations from 5,792 students in 9th grade (elementary) and 1st year (secondary), gathered from 2018 to 2019.

The findings demonstrate that the transformer architecture initially exhibits slower performance due to its need for greater data volume to attain predictive accuracy comparable to other models; yet, with adequate data, it exceeds their performance. An advantage of transformers is their lack of necessity for data preparation, which enhances their flexibility and adaptability across diverse educational contexts; yet, they necessitate

extended training durations.

The findings for the second research question indicate that Gradient Boosting excelled in early detection scenarios, yielding favorable outcomes with fewer assessments—essential for prompt pedagogical intervention for at-risk children.

The study illustrates a pedagogically beneficial application of AI, facilitating the identification of underperforming students and aiding in the formulation of remedial action plans. The discourse on data ethics is confined to the acknowledgment of dataset anonymization, neglecting to confront more profound issues regarding the utilization of student assessment data and associated privacy dangers.

V. Results

This section delineates the findings of the analysis of the chosen publications. This research indicates that the artificial intelligence techniques employed in education include computer vision, machine learning, data mining, and natural language processing (NLP).

All the examined papers employ machine learning as the technique. Russell and Norvig (2010) assert that machine learning transpires when a computer constructs a model through the observation of a dataset, subsequently formulating a hypothesis that elucidates the functioning of the world.

Data mining, as discussed in the research by Soares et al. (2023) and Oliveira and Medeiros (2024), is an AI technique that, according to Agarwal (2013), facilitates the analysis of extensive datasets to uncover patterns and insights, thereby revealing knowledge unattainable through conventional database systems.

Natural language processing (NLP) seeks to convert human language into a format readily interpretable by computers (Goodfellow & Yoshua, 2016). This technique appears in the research of Peronaglio et al. (2023).

Computer vision, as utilized by Werlang and Jaques (2023), is characterized by AWS (c2023) as a method that allows machines to accurately identify and describe images.

The investigation reveals that artificial intelligence is predominantly utilized in teaching and learning, as well as in educational administration and management.

In the educational sector, the research conducted by Werlang and Jaques (2023), Pereira Júnior, Araújo, and Dorça (2023), Peronaglio et al. (2023), Russo, Sant'Anna, and Imai (2023), and Aquino, Souza, and Barrére (2023) utilizes AI to deliver advantages for both students and educators. Students benefit from recommended educational resources and automatic content adaptation to their unique learning styles; teachers utilize AI tools for categorizing educational videos and optimizing instructional materials to align with students' learning profiles.

In the realm of administration and management, the research conducted by Soares et al. (2023), Rauber et al. (2023), Oliveira and Medeiros (2024), and Rodrigues et al. (2024) centers on elucidating the factors contributing to school dropout, forecasting subpar academic performance, and formulating models for learning assessment.

Concerning which studies examined ethical problems in artificial intelligence, it was determined that only the research conducted by Werlang and Jaques (2023), Pereira Júnior, Araújo, and Dorça (2023), and Rauber et al. (2023) specifically addressed ethical issues in their findings.

VI. Discussion

The selected studies reveal the artificial intelligence techniques presently employed in educational settings. It is noteworthy that, apart from machine learning and data mining, the other two techniques—computer vision and natural language processing—were mentioned only once each. This may signify either a constraint stemming from utilizing a specialist publication as a data source or a prospective research trend suggesting novel avenues for AI applications in education. Future research may investigate more extensive indexing databases and other specialized journals in educational informatics to validate or challenge this observation.

The examined papers reveal that AI applications in education predominantly focus on the teaching and learning sector. Nevertheless, few research directly addresses the classroom situation, including studies by Russo, Sant'Anna, and Imai (2023) and Rauber et al. (2023).

Consequently, the response to the second guiding question of this research is clear: the domains most prominently associated with the application of artificial intelligence are pedagogy and educational administration/management.

The AI applications recognized in the educational domain include: a) Emotion Detection for Pedagogical Intervention; b) Educational Data Analysis; c) Identification of Educational Performance Factors; d) Recommendation of Learning Objects; e) Intelligent Tutoring Systems; f) Image Synthesis; g) Learning Assessment; h) Automatic Classification of Educational Videos; i) Prediction of School Dropout; and j) Prediction of Academic Performance.

Each study distinctly illustrates a unique application of AI, underscoring the diversity of possibilities

and the extensive range of potential research avenues related to artificial intelligence in education.

Upon reviewing the studies that tackled ethical issues, it is evident that none offered a profound analysis or discourse on the subject. Several individuals provided succinct remarks regarding licensing issues or the anonymization of datasets. Several studies received ethics committee assessment; however, even these failed to participate in a meaningful discourse regarding the ethical ramifications of utilizing data for artificial

Acknowledgements

This integrative review identified the primary artificial intelligence approaches utilized in the Brazilian educational setting, together with the educational domains in which these techniques are implemented and their respective purposes.

Machine learning, data mining, natural language processing, and computer vision techniques have been utilized in the Brazilian educational sector, particularly in teaching and learning as well as educational administration and management.

A noteworthy result is that each study examined in this review pursued distinct objectives, illustrating the diversity of AI applications and the potential for new research projects as well as the continuation of established ones.

This analysis highlights a significant observation: few studies have investigated direct classroom applications, indicating a critical research gap that requires attention.

A relevant aspect pertains to the ethical dimension: while certain studies were presented to ethics committees, none of the examined works undertook a meaningful discourse regarding the ethical ramifications of AI utilization in education. This absence highlights the necessity to enhance the discourse on data governance, privacy, bias, and accountability in the application of artificial intelligence for educational objectives.

It is crucial to emphasize that, owing to the constraints of the data sources and the limited timeframe utilized for article selection, future research should encompass a wider scope—both temporally and in terms of database inclusivity—to facilitate a more thorough and representative comprehension of the role of artificial intelligence in Brazilian education.

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