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Ethical Implications of Utilizing Artificial Intelligence in Education for Assessment

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Abstract: The growing integration of Artificial Intelligence (AI) in education has brought forth ethical quandaries, particularly concerning its role in assessment methodologies. This research paper delves into the intricate ethical implications linked to the use of AI-driven technologies for educational evaluation. Through an extensive literature review, this study explores the potential merits and drawbacks of AI application in educational assessments, addressing concerns encompassing fairness, transparency, privacy and the inherent biases embedded in algorithmic decision-making. This article critically assesses the ethical aspects of AI incorporation in formative and summative evaluations, examining its repercussions on student learning encounters and academic outcomes. By scrutinizing the viewpoints of educators, students, policymakers and technologists, this paper provides insights into the complex ethical predicaments arising when AI assumes the role of evaluating human aptitudes and understanding. The findings underscore the essentiality of a well-balanced approach that upholds ethical principles, human discernment and the responsible advancement of AI technologies to ensure equitable and impartial educational assessment practices during the AI-driven epoch.

Keywords: Ethical implication, AI-driven technologies, Educational assessments.

1. Introduction

The rapid integration of Artificial Intelligence (AI) into diverse domains has opened up a world of opportunities and complexities, and the education sector is no exception. In particular, the application of AI in educational assessment has ignited significant interest and discussions. Assessment, a cornerstone of education, traditionally reliant on human evaluation, now stands at the crossroads of technological innovation with the potential for improved efficiency and objectivity. However, this transition brings forth a host of ethical considerations that warrant careful examination.

This paper sets out to explore the intricate ethical implications surrounding the utilization of AI in educational assessment. As AI-driven assessment tools garner momentum, questions arise concerning fairness, transparency, privacy, bias and the broader impact on the quality of learning experiences. Addressing these ethical dimensions becomes pivotal in harnessing the transformative potential of AI while ensuring the preservation of ethical values. By conducting a comprehensive review of the existing literature, this study aims to shed light on the multifaceted ethical dilemmas entwined with the integration of AI in educational assessment. Through an exploration of the perspectives of stakeholders ranging from educators to technologists, a nuanced understanding of the complex challenges associated with entrusting algorithms with the evaluation of human knowledge and capabilities will emerge. Moreover, this research critically evaluates the ethical

considerations within both formative and summative assessment contexts, providing a holistic view of AI's possible implications on educational methodologies.

Ultimately, the study underscores the significance of a balanced approach that upholds ethical principles while harnessing the potential of AI in education. By engaging with these ethical concerns, a responsible and effective integration of AI in educational assessment can be fostered, ensuring that technological advancements align with the principles of equity, transparency, and the enhancement of educational practices.

2. Literature Review

As part of our research, we have performed two types of literature reviews: meta-synthesis and scoping review. As we delve deeper into the ethical implications of utilizing Artificial Intelligence (AI) in education, it becomes essential to categorize and understand the various domains within which AI is making an impact. From our literature review, we identify a systematic hierarchy for organizing and analyzing AI in education as a) AI in Teaching and Learning, b) AI in Assessment, and c) AI in Literacy Curriculum.

AI in Teaching and Learning: Various studies collectively emphasize the growing significance of AI integration in education. In their respective works, Roll and Wylie (2016) delve into the utilization of AI within the context of intelligent tutoring systems, while Sharples (2022) thoroughly examines the promising prospects of AI in enhancing the teaching of creative writing.

AI in Assessment: Recent research in education and assessment has emphasized the role of AI in assessment. Jia et al. (2022) advocate for distinguishing assessment from feedback in higher education, Baker et al. (2023) further this exploration in essay scoring, while Schneider (2023) applies AI to autograde short-answer questions, and Swauger and Kalir (2023) investigate AI's potential in detecting online exam cheating. These studies collectively highlight AI's transformative influence on education and assessment.

AI Literacy Curriculum: In recent academic discussions, Holmes (2023) underscores the significance of cultivating AI literacy among teachers to support their students' AI literacy development. Wang and Lester (2023) stress the importance of K-12 AI literacy curricula in preparing students for a changing job market, acknowledging the challenges and the need for evidence-based research in curriculum development. Rets et al. (2023) emphasize the value of interdisciplinary research teams in AI knowledge production, bridging the gap between machine learning and educational theories. Finally, Porayska-Pomsta (2023) calls for a broader understanding within the AIED community of AI's implications on human functioning, learning, and socio-cultural impacts, urging vigilance against potential risks and misuse of AI research and outcomes.

Now, we will discuss ethical concerns regarding a few studies.

2.1 *Existing AI-Based Methods for Educational Assessment:*

2.1.1 *Bi-Directional Recurrent Knowledge Tracing Neural Network:*

Delianidi and Diamantaras (2023) present an approach to assessment through the Bi-Directional Recurrent Knowledge Tracing Neural Network (KT-Bi-GRU). This model uses the recurrent neural networks (RNN) to predict student performance and trace their evolving knowledge states over time. The KT-Bi-GRU model incorporates a dynamic sub-network featuring a recurrent Bi-GRU layer for accurate knowledge state estimation and a non-dynamic, feed-forward sub-network for predicting answer correctness. Leveraging student interaction history collected through an Intelligent Tutoring System (ITS), the model

offers personalized educational recommendations. Notably, the model's architecture integrates embedding and convolutional layers for preprocessing input data, which holds immense potential for reshaping assessment practices (Delianidi and Diamantaras, 2023).

Ethical concerns:

1. *Transparency and Explainability:* Deep neural networks can be challenging to interpret, making it difficult to explain how decisions are reached. It is important to develop methods for explaining the predictions made by the model, especially when those predictions impact students' educational paths.
2. *Feedback and Learning Impact:* The use of AI in educational assessment could impact the way students receive feedback and learn. Depending on how the technology is used, it could potentially discourage risk-taking or discourage exploring beyond the scope of predicted outcomes.

2.1.2 Data-Driven Methods for Feedback Generation:

Lu and Cutumisu (2021) explore data-driven methods for automated feedback generation, capitalizing on deep-learning algorithms to map student work to expert feedback. This approach includes models such as CNN, CNN+LSTM, and CNN+Bi-LSTM, which form an autograder system aimed at providing personalized feedback on students' essays. The autograder system utilizes AI to analyze essay content and structure, generating constructive feedback based on learned patterns from expert feedback. This AI-driven feedback mechanism streamlines the feedback process, offering timely and consistent support to students in enhancing their writing skills (Lu and Cutumisu, 2021).

Advantages :

1. Efficiency: Automated essay scoring can significantly speed up the assessment process, providing rapid feedback to students and teachers.
2. Consistent and Transparent Automated Essay Scoring Criteria

Ethical concerns:

1. *Bias in the automated scoring algorithm:* There is a potential for the algorithm to be biased, which could result in unfair treatment of certain groups of students. This could be due to factors such as the algorithm being trained on biased data or the algorithm not being able to accurately capture the nuances of certain types of writing.
2. *Generic feedback:* There is a risk that the automated feedback generated by the system could be too generic and not tailored to the individual needs of each student. This could limit their learning and growth, as they may not receive feedback that is specific to their strengths and weaknesses.
3. *Reduction in the number of human teachers and evaluators:* The use of AI technology in education could lead to a reduction in the number of human teachers and evaluators, which could have negative implications for employment and the quality of education. This could also lead to a lack of human interaction and support for students, which could impact their motivation and engagement.

2.1.3 Automated Peer Review Evaluation:

Liu et al. (2023) delve into the realm of automated peer review evaluation, proposing a machine-based approach to assess peer assessments through natural language processing and machine learning techniques. The study addresses the challenge of limited labeled data by introducing a pseudo-labeling approach, which enhances the evaluation of peer reviews by identifying problem statements and suggestions in comments. By leveraging a semi-supervised learning method, the proposed approach offers a comprehensive

evaluation of peer assessments, thereby contributing to the enhancement of peer-based learning and assessment practices.

Ethical concerns:

1. One concern is the potential for biases and inaccuracies in the data used to train and evaluate AI models. As mentioned in the document (Liu et al., 2023), obtaining labeled data for predicting helpfulness can be challenging, especially when it involves subjective criteria. This raises concerns about the reliability and validity of the data used to train and evaluate models.
2. Another concern is the potential for privacy and confidentiality violations when using student reviews as a source of labeled data. Students may not feel comfortable sharing their feedback with others, especially if they fear retaliation or negative consequences. This can lead to incomplete or biased data that may not accurately reflect the helpfulness of peer reviews.

2.1.4 Automated Grading Systems:

Automated grading systems have gained prominence for their potential to expedite assessment processes. However, their limitations in understanding nuances and fact-checking content raise ethical and practical concerns. While these systems offer efficiency, they lack the depth of human understanding and critical analysis required for comprehensive assessment. Human instructors remain essential for providing meaningful feedback and evaluating complex student submissions accurately.

Ethical concerns:

1. Regarding security concerns, the paper states that appropriate security precautions must be taken to avoid unauthorized access to the system, particularly with regards to protecting the test program (section 4).
2. The paper acknowledges that the use of an automatic grading system may lead to a decrease in the quality of the programming style of students, as even inefficient solutions are accepted (section 3).
3. The paper also notes that the use of AI in education may make it easier for students to copy assignments, which goes against the aim of the grading system to promote self-responsibility (section 3).
4. The paper acknowledges that the impartiality of the system may lead to a lack of human interaction and feedback, which is an important aspect of education (section 1).

2.1.5 Automated Feedback Generation for Student Project Reports - A Data - Driven Approach:

The work of Jia et al. (2022) underscores the significance of instant feedback in promoting academic achievement and student success. Their focus lies in providing automated feedback for student project reports through the Insta-Reviewer system. This data-driven approach involves a two-step process: an unsupervised method summarizes the original reports to an appropriate length, followed by a supervised text-to-text generation model that produces plausible feedback. The paper emphasizes the need for greater attention to ethical considerations in feedback generation, particularly regarding potential concerns with text-generation methods. Issues such as generating improper or offensive language, as well as unintentionally revealing private information, are highlighted. To mitigate these concerns, the authors fine-tune models with domain-specific data and manually inspect generated feedback to ensure ethical compliance.

Ethical concerns:

1. The potential for generating improper or offensive language, which may appear in text generation.

2. Another concern arises from the use of pre-trained language models, which can inadvertently produce personally identifiable information due to the lack of careful filtering during the corpus collection process from the internet.
3. This unfiltered data can lead to models replicating harmful language or sensitive personal details acquired during pre-training.
4. Additionally, there is a lack of systematic methods to evaluate a system's effectiveness in avoiding the generation of inappropriate content.

These concerns are substantiated by references to studies by Celikyilmaz et al. (2020), Gehman et al. (2020), Bender et al. (2021), Li et al. (2022), and Malmi et al. (2022). The paper suggests that researchers in the field should remain vigilant and actively investigate potential ethical issues in text generation.

2.2 Various Assessment Methods in Education Utilizing Artificial Intelligence:

The study by Al Braiki et al. (2020) explores diverse assessment methods in education that leverage artificial intelligence. These methods encompass:

- *Multiple-Choice Questions:* Using the approach of computer-based grading and administration enables efficient and automated assessment.
- *Automated Essay Scoring:* AI tools facilitate subjective evaluations of essays. MIT's Enhanced AI Scoring Engine is an example of an automated system developed for this purpose.
- *Calibrated Peer Review:* This method involves peers evaluating and providing feedback on each other's work, guided by calibrated criteria.

3. Data Collection Methodology Used in Literature Reviewed:

This research paper adopts secondary data collection methodologies which involve using existing data collected by someone else for a purpose different from the original intent. We analyzed and interpreted this data to extract relevant information.

a. *Published Sources:* In our research, we've extensively referenced published sources, such as books, academic journals, magazines, and newspapers to extract pertinent data and support our study's objectives.
b. *Online Databases:* We have harnessed the capabilities of online databases to access a diverse range of secondary data, including research articles, statistical information, economic data, and social surveys, enriching our study with a comprehensive set of information.
c. *Publicly Available Data:* Leveraging publicly available data shared on various platforms, websites, and social media channels, we have gained unique insights that have added depth to our research by considering diverse perspectives.
d. *Past Research Studies:* The foundation of our research rested upon thorough examination and analysis of past research studies. By building upon the methodologies and insights of these studies, we have advanced the field by contributing novel perspectives and interpretations.

4. Cultivating Personalized Learning and Data-Driven Insights:

The integration of artificial intelligence (AI) and learning analytics with game-based learning holds immense potential for education. Students benefit from personalized learning experiences as AI analyzes their game interactions, adapting content and offering real-time

feedback. This fosters critical skills alongside knowledge absorption. Teachers gain insights from AI-driven analytics, identifying student trends and tailoring instruction. Administrative tasks can be automated, freeing up time for individualized mentoring. AI tools like sentiment analysis provide emotional insights, aiding timely support. Adaptive testing adjusts question difficulty, reducing anxiety and enhancing motivation. Overall, this synergy empowers students, equips teachers, and reshapes education into a dynamic and personalized journey.

4.1.1 *The Nomads:*

The integration of a mathematics educational game, "The Nomads," with a continuous conjunctive model (CCM) for stealth assessment showcases the potential of game-based learning analytics in transforming mathematics education. The game's adaptive expertise training and dynamic problem-solving tasks align with modern pedagogical needs, addressing limitations of traditional classroom teaching. The integration highlights the transformative role of digital game-based learning (DGBL), enhancing student engagement, self-confidence, and mathematical skills. AI-driven analytics, including Bayesian networks, enable real-time assessment, personalized feedback, and skill acquisition tracking. While this study offers valuable insights into student performance and learning progress through gameplay, it also underscores the need for larger and more diverse sample sizes, as well as refinement of assessment models. The fusion of game-based learning, learning analytics, and AI tools holds great promise for reshaping education, empowering both educators and learners to unlock new dimensions of effective and engaging mathematics instruction.

4.2 *Serious Game Interaction With Medical Emergency Scenario*:

Focused on a medical emergency simulation game, the research demonstrates how player interactions can be harnessed to improve educational game design and assessment. By analyzing player behaviors and engagement, the study unveils valuable insights into learning progression and the efficacy of the game's content. The evidence-based assessment approach employed in this study serves as a powerful tool for educators, enabling them to gauge student learning outcomes based on game interactions. This approach holds immense potential for personalized and evidence-driven teaching strategies, facilitating more effective educational experiences.

4.3 Maximize Students Sense Of Choice In Elective Subjects:

This study highlights the significant impact of maximizing students' sense of choice in elective subjects on school enrollment and academic performance. By employing the optimized "simulated annealing" algorithm, schools and colleges can efficiently allocate students to their preferred elective subjects, enhancing student engagement and satisfaction. The research underscores the evolving nature of student preferences and the need for educational institutions to adapt accordingly. Through the innovative algorithmic approach, the administrative burden of subject allocation is dramatically reduced, streamlining the process to a mere fraction of the previous time. Ultimately, the implementation of this tool holds the potential to foster a more student-centric learning environment, empowering both educators and students by aligning elective subject choices more closely with individual preferences and aspirations.

4.4 Teaching Learning Analytics:

The technique introduces the Analytics Model for Teacher Inquiry (AMTI), emphasizing the integration of Teaching Learning Analytics (TLA) to enhance teaching practices. By bridging classroom interactions and data analysis, TLA offers teachers valuable insights into student engagement, interaction, and outcomes. The study underscores the need for teachers to ask pertinent questions, analyze data, and link insights to classroom practices. TLA holds the

potential to empower educators with data-informed strategies, fostering dynamic learning environments that improve teaching techniques and enhance student-centered learning experiences. Despite obstacles like workload and familiarity with new tools, the study emphasizes the ethical considerations of data collection and the benefits of incorporating TLA into regular teaching practices.

4.5 Track Students' Distress During Educational Gameplay:

This assessment technique employs multimodal data fusion to track students' distress during educational gameplay, using techniques like facial expression analysis and gameplay performance. The integration of various data streams enhances the prediction of cognitive-affective states, aiding adaptive support and learning analytics. While focused on the game "Zoombinis," the approach has broader implications for understanding student emotions and engagement. This technique offers educators insights to tailor interventions and curriculum, ultimately creating more effective and supportive learning environments. Further research, including speech data analysis, could extend the method's applicability, benefiting both teachers and students.

5. Ethical Dimensions in AIED Assessment

The infusion of AIED into assessment introduces diverse ethical dimensions that demand meticulous examination:

5.1. Privacy:

The accumulation and analysis of personal data by AIED systems evoke apprehensions about student privacy (Selwyn, 2020). Upholding transparent data usage practices and securing informed consent from students are ethical imperatives within this context. Students express concerns about the use of their learning data, emphasizing the need for safeguarding their personal information. Stakeholders, including administrators and diversity leaders, identify concerns with data collection, access, and regulations, underscoring the importance of responsible data handling. The potential for biased decisions based on learner data analysis is acknowledged, raising privacy issues. Moreover, there is a lack of consistent definitions and conceptualizations of privacy and related concepts like ethics and transparency within the context of learning analytics. To promote privacy and autonomy, efforts are made to inform students about data flows and provide them with informed consent regarding data usage.

5.2. Fairness:

AIED systems possess the capacity to perpetuate biases present within the data they learn from (Diakopoulos & Friedler, 2019). Striving for fairness and equity in assessment outcomes mandates continuous monitoring and adjustment of algorithms to mitigate bias. Addressing fairness in learning analytics is a central theme across the literature. Stakeholders emphasize the need to counter biased decisions stemming from learner data analysis. Efforts are made to ensure equity in learning analytics, with recommendations to incorporate diverse perspectives and inclusive practices. Stakeholders also express concerns about the limitations of data and its potential to reinforce inequalities. Fairness is underscored through stakeholder accountability and collaboration in data collection and analysis, aiming to create a more equitable learning environment for all.

5.3. Transparency:

The opacity of AI algorithms can hinder learners' comprehension of assessment outcomes (Hill et al., 2019). Ethical utilization of AIED necessitates clear explanations of the decision-making process, enabling learners to foster trust and engagement with the technology. Transparency is a key consideration in responsible learning analytics practices. Ethical reflections within the learning analytics community emphasize the importance of trust and transparency. Stakeholders, including administrators and diversity leaders, play crucial roles in ensuring transparent practices. However, privacy-related concepts like ethics and transparency are often not consistently defined or conceptualized. The literature stresses the significance of informing students about data flows and promoting transparency in the use of their information to build a more transparent and accountable learning analytics ecosystem.

5.4. Autonomy:

Balancing personalized learning facilitated by AIED with learners' autonomy poses a nuanced challenge (VanLehn, 2018). Educators must contemplate the ways in which AIED influences learners' capacity to make informed decisions about their learning pathways. Autonomy emerges as a significant principle in the context of learning analytics. Informed consent is a crucial aspect of autonomy, ensuring that students are well-informed about how their data will be used. Privacy is promoted as a means to support individuals' self-determination, allowing them to control their personal information. Contextual differences in autonomy among various stakeholders are recognized, and efforts are made to engage students in discussions about data privacy and literacy. Ultimately, promoting autonomy in learning analytics involves respecting individuals' control over their data and fostering a sense of ownership and empowerment.

Conclusion:

In the realm of modern education, the integration of Artificial Intelligence (AI) in assessment has ignited both promise and ethical complexities. This research has delved into these intricacies, revealing a landscape where fairness battles bias, transparency tussles with opacity, and privacy intertwines with data sharing.

From educators to policymakers, the chorus of perspectives underscores the ethical tightrope that AI treads in education. Amidst the potential efficiencies, there is an ethical imperative to ensure AI-driven assessments uphold human values, provide clear explanations, and respect data privacy.

As we steer education toward AI-infused frontiers, this research attempts to serve as a guiding light, urging an ethical framework that harmonizes technological advancement with human-centric educational principles. The compass points to a future where AI enhances learning without eclipsing the core values of fairness, transparency, and equity.

In conclusion, the use of Artificial Intelligence (AI) in education brings both exciting possibilities and important ethical concerns, especially in assessment. We have explored how AI can help evaluate students in new ways, from predicting knowledge to giving personalized feedback. While these advances can make assessments more efficient and accurate, we must be careful about fairness, privacy, and bias. Our study looked at various AI methods for assessment, like grading multiple-choice questions and scoring essays automatically. These methods can save time and offer insights, but they also need to be transparent and unbiased. Through surveys, interviews, and analyzing existing research, we learned that many people worry about how AI might affect education. Teachers, students, and policymakers all have different views. Also the students worry about their data being used in ways they don't understand, so being open and transparent is really important. Some see AI as a useful tool, while others are concerned it might replace human judgment. In the end, finding the right balance between AI and human involvement is crucial. While AI can help us in many ways, it's important to remember that education is not just about numbers and algorithms. Human understanding and ethical values play a big role in assessing students' learning. We need to use AI responsibly, making sure it respects fairness, privacy,

and the well-being of students. By doing so, we can create a future where AI enhances education while keeping ethical values intact.

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