AI-Driven Educational Paradigms: Opportunities and Challenges, and Ethical considerations in Teaching and Learning

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Résumé

Cet article explore le potentiel de l'Intelligence Artificielle dans l'Éducation (IAE), examinant ses opportunités, ses défis et ses considérations éthiques. L'IA a la capacité de transformer l'éducation en permettant des expériences d'apprentissage personnalisées, une prise de décision basée sur les données et des approches pédagogiques innovantes. Cependant, il est impératif d'évaluer ses implications de manière critique. L'étude aborde quatre questions directrices : Comment l'IA contribue-t-elle à l'apprentissage personnalisé ? Quelle est l'efficacité des systèmes d'apprentissage adaptatifs pilotés par l'IA ? Quels sont les défis éthiques de l'IA dans l'éducation ? Comment peut-on établir des lignes directrices éthiques pour l'intégration de l'IA ? La recherche vise à atteindre quatre objectifs : évaluer l'impact de l'IA sur les expériences d'apprentissage personnalisées, analyser l'efficacité des systèmes d'apprentissage adaptatifs pilotés par l'IA, explorer les considérations éthiques et les défis dans l'application de l'IA, et proposer des lignes directrices pour l'intégration éthique de l'IA dans la recherche éducative. À travers un paradigme de recherche par méthodes mixtes, l'étude offre des perspectives sur le rôle de l'IA dans l'éducation, discute des limitations et esquisse des orientations futures, éclairées par une revue exhaustive de la littérature et des perceptions des différents acteurs éducatifs.

Mots-clés

IA, Éducation, Apprentissage Personnalisé, Systèmes d'Apprentissage Adaptatif Pilotés par l'IA, Opportunités, Défis, Considérations Éthiques.

Abstract

This paper explores the potential of Artificial Intelligence in Education (AIEd), examining its opportunities, challenges, and ethical considerations. AI has the capacity to transform education by enabling personalized learning experiences, data-driven decision-making, and innovative pedagogical approaches. However, it is imperative to critically assess its implications. The study addresses four guiding questions: How does AI contribute to personalized learning? What is the efficacy of AI-driven adaptive learning systems? What are the ethical challenges of AI in education? How can ethical guidelines be established for AI integration? The research aims to achieve four objectives: assessing AI's impact on personalized learning experiences, analyzing the effectiveness of AI-driven adaptive learning systems, exploring ethical considerations and challenges in AI application, and proposing guidelines for ethical AI integration in educational research. Through a mixed-method research approach, the study offers insights into AI's role in education, discusses limitations, and outlines future directions, informed by a comprehensive review of literature and perceptions of the different educational stakeholders.

Keyword

AI, Education, Personalized Learning, AI-Driven Adaptive Learning Systems, Opportunities, Challenges, Ethical Considerations

مستخلص

تستكشف هذه الورقة إمكانات الذكاء الاصطناعي في التعليم(AIEd)، وتدرس الفرص والتحديات والاعتبارات الأخلاقية. يتمتع الذكاء الاصطناعي بالقدرة على تحويل التعليم من خلال تمكين تجارب التعلم الشخصيّة، واتخاذ القرارات القائمة على البيانات، والأساليب التربوية المبتكرة. ومع ذلك، فمن الضروري تقييم آثارها بشكل نقدي. تتناول الدراسة أربعة أسئلة توجيهية: كيف يساهم الذكاء الاصطناعي في التعلّم الشخصي؟ ما مدى فعاليّة أنظمة التعلم التكيفيّة المعتمدة على الذكاء الاصطناعي؟ ما هي التحدّيات الأخلاقيّة للذكاء الاصطناعي في التعليم؟ كيف يمكن وضع مبادئ توجيهية أخلاقية لتكامل

الذكاء الاصطناعي؟ ويهدف البحث إلى تحقيق أربعة أهداف: تقييم تأثير الذكاء الاصطناعي على تجارب التعلم الشخصية، وتحليل فعالية أنظمة التعلم التكيفية المعتمدة على الذكاء الاصطناعي، واستكشاف الاعتبارات والتحديات الأخلاقية في تطبيق الذكاء الاصطناعي، واقتراح مبادئ توجيهية لدمج الذكاء الاصطناعي الأخلاقي في التعليم. من خلال نموذج المنهج المختلط، تقدّم الدراسة رؤى حول دور الذكاء الاصطناعي في التعليم، كما تناقش القيود، وتحدّد الاتجاهات المستقبليّة، مستنيرة بمراجعة شاملة للأدبيّات وتصوّرات مختلف أصحاب المصلحة.

كلمات مفتاحيّة

الذكاء الاصطناعي، التعليم، التعلم الشخصي، أنظمة التعلم التكيفيّة المعتمدة على الذكاء الاصطناعي، الفرص، التحدّيات، الاعتبارات الأخلاقيّة.

1.Introduction

In recent years, the integration of Artificial Intelligence (AI) technologies into various sectors has revolutionized processes, enhanced efficiency, and unlocked unprecedented opportunities for innovation. Education, as a fundamental pillar of societal progress, is no exception to this transformative wave. The amalgamation of AI with educational practices has ushered in a new era of possibilities, promising personalized learning experiences, adaptive teaching methodologies, and improved educational outcomes (Wang et al, 2023). However, alongside these opportunities lie significant challenges and ethical considerations that demand careful examination (Kooli, 2023).

1.1. Rationale and Importance:

The advent of AI in education marks a paradigm shift in teaching and learning methodologies, offering tailored approaches to meet the diverse needs of learners. As educators strive to cater to individual learning styles and abilities, AI presents itself as a powerful ally, capable of analyzing vast datasets, identifying patterns, and delivering customized learning experiences. Moreover, in an era characterized by rapid technological advancements, preparing students for the future workforce necessitates the integration of AI literacy and skills into the educational curriculum.

As such, understanding the implications, potentials, and limitations of AI-driven educational paradigms becomes imperative. This research seeks to delve into the multifaceted landscape of AI in education, exploring its opportunities, challenges, and ethical dimensions to inform policy-

making, pedagogical practices, and research endeavors in Lebanon, especially that literature, so far, has failed to contextualize AI use in our educational settings and rather provides insights on its implementation in European, Chinese, and American schools. Thus, this study will add direct insights to the Lebanese context as it was conducted with the contribution of Lebanese educational stakeholders.

1.2. Background:

The term “Artificial Intelligence” (AI) was first mentioned by John McCarthy in 1956 and refers to the ability of computer systems to undertake human tasks such as learning and thinking, which can only be attained through human intelligence (Sadiku et al., 2021). The evolution of AI in education traces back to the early applications of intelligent tutoring systems and computer-assisted instruction. Since the 1970, advancements in machine learning, natural language processing, and data analytics have propelled AI technologies into mainstream educational settings. The aim of AIED is to establish AI-powered systems such as virtual pedagogical agents, AI robots and intelligent systems, which allow flexible, engaging, and personalized learning as well as to automate daily tasks of teaching such as feedback and assessment (AlFarsi et al., 2021). The last few years, the topic of AI has been empowered by the groundbreaking technology of deep learning (Sejnowski, 2020) , which allowed the successful application of AI to several complex machine learning tasks (Dimitriadou & Lanitis, 2023). In brief, adaptive learning systems, personalized recommendation engines, and virtual assistants are now commonplace tools augmenting traditional teaching methodologies.

The significance of integrating AI into education lies in its potential to revolutionize learning experiences. By leveraging AI algorithms, educators can tailor instructional content, pace, and assessments to suit individual learner profiles, thereby enhancing engagement, retention, and mastery of concepts. Furthermore, AI-driven analytics provide educators with actionable insights into student progress, facilitating timely interventions and differentiated instruction.

1.3. Research Questions:

To guide this inquiry, four central research questions emerge:

How does AI contribute to personalized learning experiences?

What is the efficacy of AI-driven adaptive learning systems in educational settings?

What are the ethical considerations and challenges associated with AI in education?
How can ethical guidelines be established for the responsible integration of AI into educational research?

1.4. Objectives:

This study aims to achieve the following objectives:
To assess the impact of AI on personalized learning experiences through empirical analysis and literature review.
To analyze the effectiveness of AI-driven adaptive learning systems in enhancing educational outcomes.
To explore ethical considerations and challenges inherent in the application of AI in education, drawing on theoretical frameworks and case studies.
To propose guidelines for the ethical integration of AI in educational research, informed by best practices and stakeholder perspectives.
By addressing these research questions and objectives, this study endeavors to contribute to the ongoing discourse surrounding AI in education, fostering informed decision-making, and ethical AI adoption in educational settings in Lebanon.

2.Methodology

2.1. Research Design:

This study adopts a mixed-method research design to investigate the opportunities, challenges, and ethical considerations surrounding Artificial Intelligence in Education (AIEd). The research design integrates quantitative data collection through surveys with qualitative data collection via focus group discussions and Key Informant Interviews (KIIs). This approach allows for a comprehensive exploration of AI's impact on educational paradigms.

2.2. Sampling:

The sampling strategy encompasses a diverse range of participants, including educators, students, AI experts, and educational stakeholders. A purposive sampling technique was employed to ensure representation across different demographics, educational settings, and levels of expertise in AI

and education.

Two separate surveys targeted 115 (K-12) teachers and 200 high schoolers in grades 10 to 12, three focus discussion groups were conducted with parents, and another five KIIs took place with Lebanese AI experts to collect different perspectives on how AI is being integrated and influencing education in Lebanese educational settings.

2.3. Data Collection Instruments:

2.3.1. Survey Questionnaire

Two separate structured survey questionnaires were developed to collect quantitative data by 115 (K-12) teachers and 200 high schoolers regarding their perceptions, experiences, and preferences related to AI in education. The questionnaires were designed based on the guiding questions and research objectives outlined in the abstract, covering topics such as personalized learning experiences, effectiveness of AI-driven adaptive learning systems, and ethical considerations.

Surveys were administered electronically to participants, with clear instructions provided for completion.

2.3.2. Focus Group Discussions

Three focus group discussions were conducted, with six parents each from different schools, to gather qualitative insights and perspectives on the use and impact of AI in education. Semi-structured interview guides, aligned with the research objectives, facilitated the discussions among participants. Themes explored included perceptions of AI's role and impact in education, the opportunities it offered, the challenges faced, and the potential ethical implications. Two focus group discussions took place virtually through Microsoft Teams, while the third one was conducted in person, with audio recordings and detailed field notes taken to capture participant responses accurately.

2.3.3. Key Informant Interviews (KIIs)

In-depth key informant interviews were conducted with five Lebanese AI experts. Open-ended questions were utilized to elicit expert perspectives on the impact of AI on personalized learning and adaptive learning systems, the challenges faced, the opportunities offered, and the ethical considerations and guidelines to be addressed for a transparent, fair, and accountable AI integration

in education. Recommendations for establishing ethical frameworks were sought from these interviews. These Key Informant Interviews were scheduled online through Microsoft teams at the convenience of the participants, with semi-structured interview guides used to facilitate in-depth conversations and consent forms that guarantee confidentiality and transparency.

2.4. Data Analysis

Data analysis employed a mixed-method approach, integrating both quantitative and qualitative findings. Quantitative data from surveys was analyzed using statistical techniques such as descriptive statistics and inferential analysis through Power BI. Qualitative data from focus group discussions and KIIs were thematically analyzed, identifying recurring themes and patterns. Triangulation of findings from different data sources provided a comprehensive understanding of the role of AI in education and its associated challenges.

2.5. Ethical Considerations

This research adhered to ethical guidelines for research involving human subjects, ensuring informed consent, confidentiality, and respect for participants' autonomy and privacy. Ethical considerations were carefully addressed throughout the research process, with particular attention paid to sensitive issues surrounding AI and education.

2.6. Conclusion

The mixed-method approach outlined in this methodology enabled a thorough investigation of AI-driven educational paradigms, offering insights into personalized learning, effectiveness of adaptive systems, ethical considerations, and guidelines for AI integration in educational research.

3.Findings

The responses to the research questions by the different stakeholders involved in the study were categorized under five themes as follows:

Theme 1: Impact of AI on Personalized Learning Experiences

Theme 2: Effectiveness of AI-Driven Adaptive Learning Systems

Theme 3: Opportunities of AI in Education

Theme 4: Challenges of AI in Education

Theme 5: Ethical Considerations of AI in Education

The results will be presented according to the nature of the respondent and data collection tool utilized.

3.1. Theme 1: Impact of AI on Personalized Learning Experiences

Three questions fall under this theme, and the responses from the different stakeholders involved came as follows:

Question 1: How do you perceive the impact of AI technology on personalized learning experiences in education?

When enquiring about the impact of AI technology on personalized learning in education, students responses came as follows 76% of High School students which represents the majority believed that using AI in education can enhance their personal learning experience while a small portion 8% of students do not see the benefits and a notable percentage of 16% are uncertain

In terms of teacher's survey responses, a significant majority of 84% agree that AI Khan lies personalize learning experiences for students and cater to individual learning needs add preferences while a small portion of teachers 6% are skeptical and 10% remain neutral.

In terms of parents' perceptions regarding this issue 100% of parents strongly agreed that AI contributes to a large extent in personalizing is there children's learning experiences since many ai-powered platforms are available and offering valuable educational resources tailored to their kids needs and interests such as Khan Academy, Khan Academy kids Duolingo in addition to chatbots like ChatgPT.

Within the same regard, experts' opinions converge with that of parents. all responses focused on the fact that AI technologies have the potential to completely transform personalized learning by offering more accessibility to students, adaptable content to meet different needs, interests, and learning styles, targeted interventions, customized learning pathways, and real-time feedback to optimize student learning outcomes, thus enabling students not only to receive but also interpret information in a way that suits them.

Question 2: Can you share examples of how AI has enhanced personalized learning for students in educational settings?

When asked about how AI has practically enhanced personalized learning for students in educational settings, 21.6% of students stated that AI helped them learn better by personalizing learning experiences, 73% believed that it assists the teachers in identifying areas where they needed extra help, add 16.7% indicated it provided them with personalized recommendations for study materials.

As for teachers, an 81% majority agreed that AI enhanced students' personalized learning experiences by helping them understand difficult topics better, and 78% recognized the potential of AI to provide instant feedback, thus ensuring the needed data ant path to follow food improving their learning.

From their side, parents confirmed that AI has proven to be beneficial for their children's personalized learning curing educational apps platforms that offer skill practice material and interactive resources tailored to their needs, interests, and learning styles.

As for AI experts, they indicated that AI powered- technologies have contributed to the reduction of academic success difference between high and low achievers by 20% through offering Intelligent Tutoring Systems (ITS), which provide immediate feedback and support for students as well as teachers, helping them to have actionable plans and database results. adaptive learning platforms are another example mentioned; they can adjust content and Peace to match students' progress such as “Expert Path”, which provides data on students' learning loss assign specific grouping of students in terms of activities and assignments that align with the objectives of the lesson, thus facilitating data-based and speculation-free differentiated instruction.

Question 3: What are the key benefits of using AI to tailor learning experiences to individual student needs?

When asked about the key benefits of using AI to tailor learning experiences to individual student needs, responses were given from three different perspectives. Both students and parents indicated that AI has provided fun learning, engaged all their senses while learned, simplified difficult concepts, and offered instant feedback, which helped correct mistakes and eventually experience progress in real-time. Teachers stated that AI allows them to scale personalized instructions to many students, which guarantees teaching efficiency and helps them give targeted support and feedback. AI experts believe AI enables overall student progress and improved outcomes along

with increased motivation and engagement.

3.2. Theme 2: Effectiveness of AI-Driven Adaptive Learning Systems

Similarly to theme 1, three questions fall under this theme. They targeted AI experts, whose responses came as follows:

Question 1: From your experience, how effective are AI-driven adaptive learning systems in Lebanese schools?

When inquired about the effectiveness of AI-driven adaptive learning systems in Lebanese schools, AI experts agreed that though it is currently rather limited, schools in Lebanon are more aware of the importance of integrating these systems in their curricula and investing more in preparing their infrastructure and training their staff to embrace this AI Revolution. Moreover, the New Lebanese curricula to be soon adopted are embedding AI into competencies and learning objectives, allocating specific teaching periods to ensure effectiveness through introducing students to AI-driven robotics, coding, and STEM projects. Experts attributed this lag of AI in education in Lebanon to the economic crisis that hit the country in 2019, which has slowed down a formal and systematic launch of AI in the Lebanese education sector. However, experts confirmed that the academic year 2023-2024 is witnessing a rising interest by schools in this regard.

Question 2: What evidence or metrics do you consider when evaluating the effectiveness of AI-driven adaptive learning systems?

As for the evidence or metrics that AI experts consider when evaluating the effectiveness of AI-driven adaptive learning systems, they comprise student progress data such as assessment scores, student engagement levels, personalization accuracy, feedback quality, retention rates, student, teacher, and parents' satisfaction surveys, comparative studies, and long-term impact assessments.

Question 3: In what ways do AI-driven adaptive learning systems contribute to student achievement and academic outcomes?

As for how AI-driven adaptive learning systems contribute to student achievement and academic outcomes, AI experts stated that it provided personalized learning pathways, targeted interventions, optimized resource allocation, continuous improvement, and increased engagement. These systems tailor instruction to individual student needs, identify areas for improvement, and

adapt over time to better meet students' changing needs, ultimately enhancing their academic progress and success.

3.3. Theme 3: Opportunities of AI in Education

One question falls under this theme, and the responses from the different stakeholders involved came as follows:

What opportunities do you see for the integration of AI in education to improve teaching and learning practices?

When asked about the opportunities offered by AI in education, students varied in their responses. 23.7% stated that it made learning more interactive and engaging, 21.6% believed that it personalized learning experiences, 19.5% indicated that it provided instant feedback on assignments and quizzes, 17.3% reported that it assisted the teachers in identifying areas where students needed extra help, 16.7% revealed that it provided personalized recommendations for study materials, while a mere 0.2% confirmed that it assisted in class research and teacher explanation

From teachers' perspective, 81% of the surveyed teachers agreed that AI helped students understand difficult topics better, 84% believed it personalized student learning experiences, 78% recognized AI potential to provide instant feedback to students on their work, 90% stated that AI assisted in creating engaging and interactive learning activities, and 88% confirmed that AI helped them save time in preparing lessons and materials.

Parents' responses in that AI acts as a facilitator and consultant. It saved their children's time and responded to their different needs and interests by providing them with a large array of educational resources and adaptable content, giving immediate non-judgmental feedback to help them spot their mistakes, correct them, and experience real-time progress, and offering engaging practice that guarantees their involvement and encourages them to dig deeper in learning, thus strengthening their self-confidence, autonomy, and sense of achievement.

AI experts believe that AI offers numerous opportunities in education in terms of providing students with personalized learning experiences, increasing engagement in learning, and receiving real-time feedback. At the level of teachers, AI helps educators make data-driven decisions assists them in analyzing student data in a more organized and comprehensive way, and provides them

with the right tools and extra time to plan differentiated lessons and design various activities and assessments tailored to the learners' different needs, abilities, intelligences, and learning styles.

3.4. Theme 4: Challenges of AI in Education

One question falls under this theme, and the responses from the different stakeholders involved came as follows:

What challenges face the effective use and implementation of AI technologies in educational settings?

In terms of the challenges that face the effective use and implementation of AI in educational settings, students listed numerous ones: 58% considered the possibility of AI making mistakes or giving incorrect information as a concern, 4.6% indicated slow internet connection as their biggest challenge, 28.6% mentioned dealing with rising technical issues as an obstacle, 14% stated the destruction and fatigue caused by long screen time, while 12.3% agreed that they faced difficulty understanding how to use new applications or software.

From their side, teachers raised of AI used in education such as: technical issues, overreliance on AI, training needs, AI real ability to address individual needs, content bias, and content inaccuracies. In fact, 63% of teachers agreed that technical issues with AI tools can disrupt classroom activities , 69% stated that overreliance on AI may lead to students becoming more dependent in their learning, a majority of 81% confirmed that integrating AI into existing teaching methods requires additional training for them as teachers, 55% revealed that AI may not be able to address the individual needs of every student, 62% indicated that AI systems may introduce biases in educational content, while 64% believed that AI systems may introduce inaccuracies in that content.

As for parents, they mentioned over reliance on technology, which can compromise their children's critical thinking and independence. Slow internet connection was also raised as an issue, in addition to biased information that can be provided by chatbots. They also listed their children's exposure to screens for a long time as a challenge, which may get them addicted and affect family time and relationships and result in irritability.

All AI experts agreed that adopting AI technology in educational contexts raised several barriers such as: limited internet access, poor school infrastructure, excessive cost, resources limitation

since not all students can secure their proper devices. Teachers' resistance to change is another challenge, which is engendered by a lack of training and technical skills needed for an effective use and interpretation of AI materials and the fear of job displacement. The absence of national educational laws and regulations that facilitate and legitimize online courses, notably in higher education, was also raised as an issue, along with privacy and equity concerns regarding an efficient implementation of inclusion in schools.

3.5. Theme 5: Ethical Considerations of AI in Education

One question falls under this theme, and the responses from the different stakeholders involved came as follows:

What ethical considerations should be considered when designing and implementing AI technologies in education?

The ethical considerations raised by the different stakeholders covered data privacy and security, fairness, and accountability.

Students' responses revealed that 51% expressed concerns about their personal information or data being collected and used by AI systems in education, and 59% believed they should have a say in how AI is used in education in terms of the nature of the data collected and how it is utilized to assess their learning.

As for the nature of these ethical concerns, 39.2% of students stated data privacy, 30.1% mentioned equal access to technology, 30.1% indicated protection from harmful content or online dangers, while a mere 0.3% raised AI potential of blocking their critical thinking.

When asked about the school role in ensuring a fair and ethical use of AI in education, 27.8% responded that it must be transparent about the processing of student data collection and use, 25.3% believed it must provide training for teachers and students on ethical technology use, 5% mentioned it should regularly evaluate AI systems for bias and fairness, and 21.7% stated it should involve students in decisions about how AI is used in their education, while only 0.3% of students agreed that school should not be taking any of the above mentioned measures.

As for how ethical students considered themselves while using information provided by AI tools in assignments, 65% considered themselves ethical, 23% themselves as only somewhat ethical, and 6% each admitted to being rarely or not ethical at all.

Regarding teachers' responses on the issue, a vast majority of 87% agreed that respecting and protecting student privacy by the AI systems used in education is crucial. Moreover, 90% of teachers believed schools should provide them with access to full versions of AI tools, particularly plagiarism detectors to maintain integrity and guarantee accountability. In parallel, 93% mentioned the importance of teaching students about ethical behavior when using information provided by AI. Within the same scope, 89% stated they should have input in the school decisions regarding the use of AI and education. In terms of their readiness to embrace AI in their teaching, 89% confirmed the necessity of receiving thorough training for the effective use of AI in the classroom.

As for parents, they all expressed their full trust in how school is collecting and utilizing their children's personal data. They also believed that their children are being safely exposed to AI tools in class under the supervision of teachers and school administration, especially that there are strict and high online security measures followed by the central IT Department.

AI experts highlighted several ethical considerations when designing and implementing AI technology in education. The first concern was student data privacy; educational technology captures large volumes of student data to personalize learning experiences, so experts pinpointed the importance of solid policies and practices to safeguard this information. Another concern is ensuring transparency, fairness in access to AI resources, and accountability in AI systems operations by implementing specific measures such as detecting and mitigating biases, using data transparently, establishing accountability mechanisms for students, teachers, administrators, and developers, empowering users with proper awareness and providing them with comprehensive training on the secure usage of AI, adhering to ethical guidelines, and continuously evaluating and improving operations.

4. Discussion

This discussion section interprets the findings from our study, relating them to existing literature and highlighting implications for practice and policy in the field of AI in education.

4.1. Theme 1: Impact of AI on Personalized Learning Experiences

The findings show a strong consensus among students, teachers, parents, and experts that AI

significantly enhances personalized learning experiences. This aligns with previous studies, such as those by Holmes et al. (2019) and Chen et al. (2020), which found that AI can cater to individual learning needs and preferences, thereby improving student engagement and outcomes. Most students (76%) and teachers (84%) in our study believe that AI personalizes learning effectively, which is corroborated by the unanimous support from parents and experts. This broad acceptance highlights the transformative potential of AI in creating adaptive learning environments that can address diverse learning styles and needs.

However, the uncertainty and skepticism expressed by a minority of students (8%) and teachers (6%) suggest a need for more robust evidence and better communication about the benefits and limitations of AI in education. Studies like those by Luckin et al. (2016) emphasize the importance of transparent and evidence-based implementation to build trust among stakeholders.

4.2. Theme 2: Effectiveness of AI-Driven Adaptive Learning Systems

The effectiveness of AI-driven adaptive learning systems, particularly in Lebanese schools, appears promising but underdeveloped due to economic constraints. AI experts noted that while there is growing awareness and infrastructure development, the integration of these systems is still in its emerging stages. This is consistent with findings from Kozma and Vota (2014), who highlighted economic barriers as a significant challenge in the adoption of educational technologies in developing countries.

Metrics for evaluating AI effectiveness, such as student progress, engagement levels, and satisfaction surveys, are crucial. These metrics resonate with research by Baker and Siemens (2014), who stressed the importance of data-driven evaluation in educational technology. AI's contribution to personalized learning pathways and targeted interventions, as mentioned by experts, supports the findings of recent meta-analyses (e.g., Wang et al., 2021), which demonstrate AI's potential to enhance academic achievement and bridge learning gaps.

4.3. Theme 3: Opportunities of AI in Education

AI presents numerous opportunities to improve teaching and learning practices, as identified by stakeholders in our study. Students noted increased interactivity and engagement, while teachers highlighted AI's role in personalizing learning experiences and providing instant feedback. This is

in line with the literature, where AI's potential to create engaging, adaptive learning environments is well-documented (e.g., Spector, 2016).

Parents and experts also emphasized the role of AI in saving time and facilitating data-driven decision-making for teachers. This reflects findings by Greiffenhagen (2012), who found that AI can significantly reduce administrative burdens on educators, allowing them to focus more on instructional quality. Moreover, the integration of AI in curricula, as seen in the new Lebanese educational reforms, aligns with global trends towards incorporating AI literacy in education (Touretzky et al., 2019).

4.4. Theme 4: Challenges of AI in Education

The challenges identified by stakeholders, such as technical issues, overreliance on AI, and content bias, are well-documented in the literature. For instance, Selwyn (2019) highlighted similar concerns, emphasizing the need for robust infrastructure and continuous professional development for teachers. The economic crisis in Lebanon has exacerbated these challenges, delaying the widespread adoption of AI technologies.

Students' concerns about AI errors and screen time, and teachers' apprehensions about technical issues and training needs, underline the importance of addressing these barriers to ensure effective AI integration. The issue of bias and fairness in AI content, raised by both teachers and parents, echoes the findings of Noble (2018), who discussed the risks of algorithmic bias in educational technologies.

4.5. Theme 5: Ethical Considerations of AI in Education

Ethical considerations, particularly data privacy and fairness, were prominent among all stakeholder groups. Students and teachers expressed significant concerns about data privacy, which aligns with the broader discourse on digital ethics in education (Williamson, 2017). The call for transparency and accountability in AI systems is supported by the work of Binns (2018), who argued for ethical frameworks to govern AI in educational settings.

Experts' emphasis on comprehensive training and ethical guidelines is crucial for fostering trust and ensuring the responsible use of AI. This aligns with the recommendations of the IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems (2019), which advocates for ethical

standards in AI development and deployment.

4.6. Conclusion

The findings from this study underscore the significant potential of AI to enhance personalized learning, improve teaching practices, and foster student engagement. However, realizing these benefits requires addressing the challenges related to technical issues, economic barriers, and ethical concerns. Aligning with the existing literature, this study highlights the need for robust infrastructure, continuous professional development, and comprehensive ethical guidelines to ensure the effective and responsible integration of AI in education. Future research should focus on longitudinal studies to evaluate the long-term impact of AI-driven educational technologies and develop strategies to mitigate the identified challenges.

5. Conclusion

Future Recommendations

Based on the findings and discussions presented in this research paper, several recommendations can be made for future research, policy development, professional development programs in AI in education and collaboration among the different educational stakeholders.

Firstly, further research is needed to explore AI technologies' long-term effects and impacts on student learning outcomes and engagement in Lebanon. Longitudinal studies and large-scale empirical research can provide valuable insights into AI applications' effectiveness and potential risks in education (Zawacki-Richter et al.).

Secondly, Lebanese policymakers should develop guidelines and regulations to ensure AI's responsible, ethical use and legitimacy in education. These guidelines should address data privacy, algorithmic bias, and transparency in AI systems (Kooli, 2023; Nguyen et al., 2022) and certify online courses.

Thirdly, professional development programs should be designed to mitigate teachers' resistance to change by increasing their theoretical and practical knowledge about AI and providing them with the necessary skills and competencies to effectively integrate AI technologies into their teaching practices (Nazaretsky et al., 2022; Vasoya, 2023).

Lastly, collaboration among researchers, AI experts, educators, and industry professionals should be encouraged to foster innovation and advance the field of AI in education. Collaborative research projects, joint conferences, and knowledge-sharing platforms can facilitate the exchange of ideas and best practices (Zawacki-Richter et al., 2019).

Overall, this current revolution of AI presents both opportunities and challenges for education. Applying generative AI, chatbots, analytics, and personalized learning experiences can improve learning efficiency, provide customized educational support, and automate teachers' administrative tasks. However, implementing AI in education must be guided by ethical principles and careful consideration of the potential risks and limitations. Students, educators, parents, AI experts, and policymakers must actively engage in the dialogue and decision-making processes to ensure AI's responsible and equitable use in education. Future research should address ethical concerns, notably cultural considerations and privacy issues associated with AI in education.

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