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Pedagogical Paradigms in the AI Era: Insights from Saudi Educators on the Long-term Implications of AI Integration in Classroom Teaching

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Abstract

This qualitative study explores the perceptions and experiences of Saudi educators regarding the integration of Artificial Intelligence (AI) in classroom teaching. Through semi-structured interviews with a purposively sampled group of teachers, the research investigates initial experiences with AI, anticipated changes in teaching roles, support and training needs, student reactions, and concerns about long-term AI integration. Employing a constructivist grounded theory approach, the study reveals a nuanced understanding of the opportunities and challenges presented by AI in education. Findings indicate a spectrum of initial responses to AI integration, ranging from enthusiasm to apprehension, emphasizing the need for comprehensive professional development and robust support systems. Educators anticipate significant shifts in their pedagogical roles, foreseeing AI as a facilitator of personalized learning but also expressing concerns about its potential to marginalize traditional teaching practices. Student reactions were generally positive, though mixed, highlighting the need for adaptive AI implementation strategies. Concerns about ethical implications and educational equity were prominent, underscoring the necessity of a balanced, ethical approach to AI deployment. The study contributes to the emerging body of literature on AI in education and offers insights for policymakers, curriculum developers, and educational technologists on effectively

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harnessing AI's potential while addressing its challenges. It calls for ongoing dialogue, professional development, and ethical considerations as AI becomes more integrated into educational systems, ensuring it serves as a supportive component within the pedagogical framework.

Keywords: Artificial Intelligence, Education, Saudi Arabia, Teacher Perspectives, Pedagogical Change, Professional Development, Educational Technology.

Introduction

integration of artificial intelligence (AI) in education has gained significant attention in recent years. AI has been explored in various fields, including medical education, radiology, and STEM education. In medical education, AI has been used for learning support, providing individualized feedback to students (Chan & Zary, 2019). It has also been proposed as a tool for medical and health informatics students, offering educational resources and tools (Sapci & Sapci, 2020). Similarly, in radiology education, AI has been integrated to augment the learning experience and improve clinical competence (Duong et al., 2019). In the broader context of education, AI has been recognized as a transformative technology with the potential to enhance the learning process. It has been applied in adaptive education systems, intelligent tutoring systems, and machine translation tools, all aimed at improving learners' experiences (Chen et al., 2020). The integration of AI in STEM education has been an emerging field, with the challenge of integrating diverse AI techniques and complex educational elements to meet instructional and learning needs (Xu & Ouyang, 2022). AI has also been explored in undergraduate medical education, although there is a lack of consensus on the curricular content and delivery methods (Lee et al., 2021). Overall, the integration of AI in education presents both opportunities and challenges. It has the potential to revolutionize teaching and learning, providing personalized and adaptive learning experiences. However, there

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are barriers to overcome, such as the complexity of integrating AI curricula and the need for educators to develop AI-specific competencies (Lee et al., 2021). As AI continues to advance, it is important for educators to stay updated on the latest developments and consider how AI can be effectively integrated into educational practices.

The integration of artificial intelligence (AI) in Saudi Arabia's educational landscape has been a topic of interest in various fields, including radiology and healthcare. Several studies have explored the knowledge and attitudes of professionals in Saudi Arabia towards AI in their respective fields. Tajaldeen & Al-Ghamdi (2020) conducted a survey-based study to evaluate radiologists' knowledge about AI's role in diagnostic radiology. The study aimed to establish a baseline to provide educational activities on AI in this field. Similarly, Khafaji et al. (2022) highlighted the scarcity of AI-related dialogue in the local imaging community in Saudi Arabia, particularly in residency training and day-to-day work. In addition to radiology, the perceptions of healthcare professionals in Saudi Arabia regarding the use of AI applications have also been investigated. Qurashi et al. (2021) conducted a cross-sectional study to explore the perceptions of Saudi radiology personnel regarding the implementation of AI. The study revealed limited availability of AI-based applications in Saudi Arabia. Alelyani et al. (2021) assessed the attitude of the radiology community in Saudi Arabia towards the applications of AI. The findings indicated a positive attitude towards AI integration in radiology. Furthermore, the knowledge and attitudes of clinical researchers in Saudi Arabia towards AI technology have been examined. Sulthan & Navas (2022) conducted a study to assess the knowledge and attitudes of clinical researchers towards AI technology. The study highlighted the importance of understanding the potential of AI in healthcare research. It is worth noting that the integration of AI in Saudi Arabia's educational landscape is not limited to the field of healthcare. Al-Ali et al. (2023) investigated

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the attitudes of dermatologists working in Saudi Arabia towards AI. The study explored their background knowledge, sources of AI information, and feelings towards AI in dermatology. Overall, these studies provide insights into the knowledge, attitudes, and perceptions of professionals in Saudi Arabia towards AI integration in their respective fields. They highlight the need for educational activities and increased awareness to effectively integrate AI into the educational landscape of Saudi Arabia.

The integration of Artificial Intelligence (AI) into educational settings is an ongoing global trend, prompting shifts in teaching methodologies, educational planning, and student engagement. The Kingdom of Saudi Arabia, with its Vision 2030 and commitment to educational transformation, is no exception to this trend. The nation's educators are at the forefront of witnessing and experiencing these technological shifts in the classroom. Their perspectives can provide invaluable insights into the future trajectory of AI in education and its potential long-term implications. While international literature is abundant with studies investigating the integration of AI in educational contexts, there's a noted paucity in research focused on Saudi Arabia, particularly from the viewpoint of its educators. Exploring this gap is crucial for framing effective policies, professional development programs, and pedagogical practices that align with the cultural and educational ethos of the of region.

Statement of Purpose

1. Understand the Perceptions: To explore and understand the perceptions of Saudi educators regarding the integration of AI tools and methodologies in classroom teaching.
2. Gauge Preparedness: To assess the level of preparedness and adaptability of Saudi educators in incorporating AI-driven technologies into their teaching practices.

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3. Identify Concerns and Challenges: To uncover potential concerns, challenges, and reservations that Saudi educators might have regarding the long-term implications of AI in their classrooms.
4. Highlight Opportunities and Benefits: To pinpoint the perceived opportunities and benefits that AI integration can bring to the Saudi educational landscape, from the lens of its educators.
5. Inform Policy and Decision-making: To provide actionable insights that can aid educational policymakers, curriculum designers, and training providers in making informed decisions about AI's role in Saudi classrooms.
6. Contribute to Global Literature: To enrich the global discourse on AI in education by introducing findings from a regionally specific, yet internationally significant, context like Saudi Arabia.

Research Questions

Understanding Initial Integration Experiences:

1. What are teachers' initial experiences and challenges when integrating AI technology into their teaching practices?

Anticipating Changes in Teaching Roles:

2. How do teachers perceive the future role of AI in altering their pedagogical responsibilities and teaching methods?

Identifying Support and Training Needs:

3. What types of support and training do educators identify as necessary to effectively incorporate AI into their teaching?

Evaluating Student Reactions to AI:

4. How do students respond to the introduction of AI in their learning environment, and what impact does it have on their engagement and learning outcomes?

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Assessing Concerns About AI in Education:

5. What are the long-term concerns of educators regarding the integration of AI in teaching, particularly in terms of pedagogy, ethics, and educational equity?

The Literature Review

AI Applications in Education

The integration of artificial intelligence (AI) in education has been a subject of research and exploration in recent years. Several studies have examined the applications and challenges of implementing AI in various educational contexts. Zawacki-Richter et al. (2019) conducted a systematic review of research on AI applications in higher education. The study aimed to provide an overview of the current state of research in this area and identify the role of educators in the integration of AI. The findings highlighted the need for more involvement and engagement of educators in AI-related research and development. In the field of medical education, Chan & Zary (2019) conducted an integrative review to explore the applications and challenges of implementing AI. The study focused on the use of AI in medical education and highlighted the potential benefits and limitations of AI integration in this context. Sapci & Sapci (2020) conducted a systematic review on AI education and tools for medical and health informatics students. The study aimed to identify the current state of AI education in medical and health informatics curricula. The findings emphasized the importance of integrating AI training into these curricula to prepare students for the evolving healthcare landscape. Chen et al. (2020) conducted a review on AI in education, focusing on its impact on learners' experiences and other aspects of the education process. The study highlighted the potential of AI to enhance personalized learning experiences and improve educational outcomes. In the context of STEM education, Xu & Ouyang (2022) conducted a systematic review on the application of AI technologies. The study

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highlighted the challenge of integrating diverse AI techniques and complex educational elements to meet instructional and learning needs in STEM education. These studies collectively demonstrate the wide range of applications of AI in education and highlight the potential benefits and challenges associated with its integration. They emphasize the need for educators to be actively involved in AI-related research and development and the importance of integrating AI training into educational curricula to prepare students for the future.

Teachers' Perceptions of AI Integration

The integration of artificial intelligence (AI) in education has gained attention and sparked discussions about its potential impact on teaching and learning. Several studies have explored teachers' perceptions of AI integration in various educational contexts. One study by Dwivedi et al. (2021) analyzed the potential of AI within education, specifically in intelligent game-based learning environments and tutoring systems. The study highlighted the transformative learning opportunities that AI can offer and the need to consider the pace of AI integration in educational settings. In the medical field, Oh et al. (2019) conducted a survey to assess physicians' confidence in AI. Although not directly focused on education, the study provides insights into healthcare professionals' perceptions of AI, which can be relevant to understanding teachers' perceptions as well. Sit et al. (2020) conducted a survey to explore the attitudes and perceptions of UK medical students towards AI and radiology. While the study focused on medical education, it sheds light on the state of education related to AI and the need for incorporating AI training in the curriculum. Schuur et al. (2021) conducted a systematic review on the training opportunities of AI in radiology. Although specific to the field of radiology, the study highlights the involvement of professional institutions and commercial companies in offering AI training and the limited involvement of academic institutes. Paranjape et al. (2019) discussed the integration of AI training in medical education. The study

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emphasized the need for seamless integration of AI across different aspects of the curriculum to prepare future healthcare professionals. In the broader context of education, Mumtaz (2000) reviewed the literature on factors affecting teachers' use of information and communications technology (ICT). While not specific to AI, the review highlighted the role of pedagogy and teachers' beliefs about teaching and learning with technology, which can be relevant to understanding teachers' perceptions of AI integration. Overall, these studies provide insights into teachers' perceptions of AI integration in various educational domains. They highlight the transformative potential of AI in education, the need for AI training in the curriculum, and the importance of considering factors such as pedagogy and teachers' beliefs in the integration process.

Saudi Arabia's Digital Transformation in Education

Saudi Arabia is currently undergoing a digital transformation in its education system as part of its Vision 2030 framework. This transformation is driven by various factors and encompasses different aspects of education. One important aspect of the digital transformation in Saudi Arabia's education system is the integration of e-learning technologies. Aljaber (2018) provides an overview of the development and evolution of e-learning in Saudi Arabia, discussing the challenges and successes associated with its implementation. The study by Alqahtani et al. (2022) explores the satisfaction and acceptance of e-learning technologies among students in Saudi higher education. The use of digital technology in teaching and learning is also being examined. Allmnakrah & Evers (2019) emphasize the need for a fundamental shift in the Saudi education system to align with the Saudi Arabian Economic Vision 2030. They highlight the importance of strategies such as critical thinking and teacher training in achieving this shift. Additionally, Allamnakhrah (2013) investigates students' perceptions of learning critical thinking in pre-service teacher education programs in Saudi Arabia. The digital transformation in Saudi Arabia's

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education system goes beyond e-learning and pedagogical approaches. It also involves the utilization of emerging technologies such as blockchain and big data. Alangari et al. (2022) discuss the development of a blockchain-based digitally secured model for the educational sector in Saudi Arabia, which aligns with the goals of digital transformation. A.Alsheikh (2019) focuses on developing an integrated framework to utilize big data for higher education institutions in Saudi Arabia, aiming to support decision-making and improve performance. Furthermore, the role of leadership and the work environment in driving digital transformation in private sector companies in Saudi Arabia has been explored by Alasiri and Alkubaisy (Alasiri & AlKubaisy, 2022). This study highlights the importance of leadership, IT alignment, and company performance in facilitating digital transformation. Overall, the digital transformation in Saudi Arabia's education system encompasses various aspects, including e-learning technologies, pedagogical approaches, emerging technologies, and leadership. These efforts align with the goals of the Saudi Vision 2030 framework and aim to enhance the quality of education and prepare students for the digital age.

Challenges and Opportunities of AI Integration

The integration of artificial intelligence (AI) in education presents both challenges and opportunities. Several studies have explored these aspects in different educational domains. In the field of medical education, Sit et al. (2020) conducted a survey to assess UK medical students' attitudes and perceptions towards AI and radiology. The study revealed that UK medical students understand the importance of AI and are keen to engage with it. However, Kolachalama & Garg (2018) highlighted the challenge of mentorship and faculty role modeling in helping students develop an understanding of how AI knowledge can be applied in the clinical setting. The integration of AI in education goes beyond the medical field. Alasadi & Baiz (2023) discussed the opportunities and concerns of generative AI in

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education and research, emphasizing the paradigm shift it brings to teaching and learning. Paranjape et al. (2019) focused on the introduction of AI training in medical education and highlighted the challenge of integrating AI into routine clinical practice. In the K-12 education context, Touretzky et al. (2019) discussed the importance of AI researchers becoming AI educators to create resources that help teachers and students understand AI. Roll & Wylie (2016) explored the evolution and revolution of AI in education, highlighting the new opportunities that lie on the horizon. The challenges and opportunities of AI integration are also evident in specific professional fields. Edwards et al. (2022) discussed the application of AI in the sonography profession, highlighting the challenges and considerations related to its implementation. Overall, these studies provide insights into the challenges and opportunities of AI integration in education. They highlight the importance of mentorship, faculty role modelling, curriculum integration, and the need for educators and professionals to understand and embrace AI to fully leverage its potential in educational settings.

Theoretical Framework

The theoretical framework for this study is informed by a synthesis of educational theory, ethical considerations in technology, and models of technological adoption and change management within educational settings. The framework is structured to support the understanding of the multifaceted impact of AI integration in education as revealed by the participants' responses.

Pedagogical Change and Teacher Role Evolution

The framework incorporates theories of pedagogical change to understand the evolving role of teachers in AI-integrated classrooms. Grounded in the work of Fullan (2007), who discusses the complexities of pedagogical change within

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educational reform, this aspect of the framework helps to analyze how AI may transform teaching methodologies and educator responsibilities.

Ethical Considerations in Educational Technology

Ethical theories related to technology use in education are applied to address concerns about data privacy, equity, and the potential dehumanization of learning. Bynum's (2000) work on the ethical challenges of information technology provides a lens through which to consider the ethical implications of AI in classrooms.

Professional Development and Adult Learning

To interpret the expressed need for comprehensive training and professional development, Knowles' (1984) theory of andragogy is utilized. This theory emphasizes the methods and principles used in adult education and offers insights into designing effective professional development programs for educators.

Technological Adoption in Education

The Technology Acceptance Model (TAM), developed by Davis (1989), is included to understand the factors influencing educators' adoption and use of AI tools. This model assesses user acceptance of technology, providing a framework to analyze how perceptions of usefulness and ease of use affect teachers' willingness to integrate AI into their teaching practices.

Change Management in Educational Institutions

Finally, Kotter's (1996) Eight-Stage Process of Creating Change is incorporated to examine how educational institutions navigate the integration of AI technologies. This model provides a framework for understanding the steps necessary for successful change management in education settings.

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Methodology Section

Research Design

The study adopted a constructivist grounded theory approach within qualitative research, which is particularly suitable for exploring the subjective experiences and perceptions of individuals within their social contexts. This approach was applied to understand the nuanced implications of AI integration in the classroom from the perspectives of Saudi educators.

Sample Selection

The sample consisted of Saudi educators with first-hand experience of AI in teaching. Participants were purposively selected to represent a diverse array of subjects and educational levels, ensuring a wide range of insights. The selection process aimed to include educators who were both enthusiastic adopters and skeptical of AI to capture a comprehensive view of its integration.

Data Collection Methods

Data were collected through semi-structured interviews, a technique aligned with the principles of grounded theory that allows for the exploration of participants' thoughts and experiences in depth. The interviews were structured around five key questions designed to elicit detailed reflections on the educators' interactions with AI technologies.

The five key questions designed to guide the semi-structured interviews and elicit detailed reflections from the educators on their interactions with AI technologies in the classroom were as follows:

1. "Can you describe your initial experiences when you first integrated AI technology into your teaching?"
2. "In what ways do you think AI might change your role as a teacher in the future?"

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3. "What kind of support or training do you think is necessary for teachers to effectively integrate AI into their classrooms?"
4. "How have your students reacted to the use of AI in their learning environment?"
5. "Can you share any concerns you have about the long-term integration of AI in teaching?"

These questions were aimed at exploring various dimensions of AI integration from the teachers' firsthand experiences to their anticipations for the future, the support they require, their students' engagement and reactions, and any reservations they might hold about the continual use of AI in educational settings.

Interviews were conducted in a setting convenient for the participants, either face-to-face or via secure video conferencing, depending on their preference and availability. All interviews were recorded with permission, ensuring participants were fully informed of their rights and the purpose of the study.

Data Analysis

In keeping with grounded theory, data analysis was iterative and began with open coding to identify initial themes directly from the data. This involved breaking down the interview transcripts into discrete codes and comparing incidents related to each code. Axial coding was then used to relate these codes to each other, forming categories and subcategories. Selective coding followed, where the core category that represented the central phenomenon of the study was identified.

Throughout the analysis, constant comparative methods were used to refine the categories and ensure they were representative of the data. Memo writing was an integral part of the analysis, serving as a record of the analysis process and aiding in the development of the emerging theory.

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Ethical Considerations

Ethical approval was secured prior to data collection. Informed consent was obtained from all participants, which included assurances of confidentiality and anonymity. Participants were also informed of their right to withdraw from the study at any stage without consequence.

Limitations

The study's constructivist grounded theory approach means that the findings are not intended to be generalized but rather to provide an in-depth understanding of the participants' experiences. The research is also limited by its reliance on the subjective interpretations of the participants' responses.

Results and Discussion

Theme 1: Readiness and Resource Availability

A key theme emerging from the educators' responses was the dichotomy between the potential of AI in education and the current state of readiness and resource availability. Teachers expressed a range of experiences, with one stating, "I was excited by the potential but found the lack of user-friendly resources a significant barrier." Another mentioned, "The first time I used AI, I was amazed at its potential, but honestly, I felt underprepared and a bit lost." This sense of unpreparedness can be partially attributed to the "steep learning curve" another teacher reported when attempting to find the right AI tools for their subject matter. These concerns are echoed in the literature, with Zawacki-Richter et al. (2019) highlighting the need for educator involvement in AI-related development, while Chan & Zary (2019) noted the challenges of implementing AI due to a lack of resources and comprehensive training.

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Theme 2: Shift in Pedagogical Roles

The anticipated shift in pedagogical roles due to AI integration was another prominent theme. One educator projected, "AI will take over the administrative tasks, allowing me to focus more on actual teaching and student interaction," suggesting a transition towards a facilitative role. Conversely, another educator highlighted potential drawbacks: "There's a chance it could marginalize our profession if we don't adapt and find ways to work with AI." The literature provides a context for this shift, with Aljaber (2018) discussing the evolving roles of teachers in a digital era, and Allmnakrah & Evers (2019) emphasizing the need for teachers to evolve alongside technological advancements.

Theme 3: Professional Development and Support

Educators unanimously called for substantial support, including professional development and technical assistance. "We need ongoing, hands-on training that is specific to the AI tools we're expected to use," one teacher noted, highlighting the need for practical training. Another stated, "It would help to have a dedicated team of IT professionals in our school to support AI integration," emphasizing the need for technical support. This aligns with Sapci & Sapci (2020), who advocate for integrating AI training into curricula, and Alqahtani et al. (2022), who stress the importance of support infrastructure for technology adoption in educational settings.

Theme 4: Student Engagement and Adaptability

Teachers reported diverse student reactions to AI, with one observing, "My students were intrigued by AI; it sparked a lot of discussions about technology and the future." However, some noted initial resistance, with another teacher stating, "Some were resistant at first, but as AI became more integrated, they began to see its value." The variability in student reactions underscores the importance of adaptability in AI

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implementation, as supported by Alangari et al. (2022), who note the significance of AI in catering to individual learning needs.

Theme 5: Ethical and Equity Considerations

Long-term integration concerns focused on the ethical and equity implications of AI. One educator voiced, "I worry about data privacy and how student information is being used by AI systems." Another expressed concerns over the widening digital divide: "There's a risk that AI could widen the gap between students who are tech-savvy and those who are not." These reflections are supported by Zawacki-Richter et al. (2019), who underscore the need for an ethical framework for AI in education and by Aljaber (2018), who highlights the need to maintain the human element in teaching amid technological advances.

Conclusion

The educators' responses reflect a complex picture of AI integration in education, marked by excitement for its potential tempered by concerns about readiness, pedagogical shifts, the need for support, and ethical considerations. These themes, informed by the literature and the educators' firsthand experiences, suggest a cautious yet optimistic approach to AI integration. For AI to be successfully integrated into the educational fabric, a comprehensive strategy involving continued professional development, robust support systems, and careful consideration of ethical and equity issues is essential.

Based on the results and discussions presented in this study, here are six recommendations:

1. Develop Comprehensive Professional Development Programs: Educational institutions should offer ongoing, tailored professional development programs that equip teachers with the necessary skills to integrate AI tools into their

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teaching practices effectively. These programs should address both the pedagogical and technical aspects of AI technologies (Knowles, 1984).

2. Establish Collaborative Support Systems: Create support systems that facilitate collaboration between teachers, AI specialists, and IT support staff. This collaborative approach can aid in troubleshooting, sharing best practices, and staying current with AI advancements (Davis, 1989).
3. Enhance Ethical and Privacy Education: Integrate training on ethical considerations and data privacy into teacher education programs to ensure educators are equipped to address these critical issues as they arise in the context of AI integration in education (Bynum, 2000).
4. Encourage Active Teacher Involvement in AI Integration: Teachers should be actively involved in the selection and implementation of AI tools in the classroom. Their insights and experiences are invaluable in shaping AI integration strategies that are pedagogically sound and aligned with student needs (Fullan, 2007).
5. Promote Equitable Access to AI Resources: Ensure equitable access to AI technologies across different schools and student demographics to prevent the widening of the digital divide. Investments should be made to provide all students with the opportunity to benefit from AI-enhanced learning (Zawacki-Richter et al., 2019).
6. Implement a Continuous Evaluation Process: Educational authorities should establish a continuous evaluation process to assess the impact of AI on teaching and learning outcomes. This process will inform ongoing improvements and ensure that AI integration is achieving its intended educational objectives (Kotter, 1996).

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These recommendations aim to guide policymakers, educational leaders, and practitioners in effectively harnessing the potential of AI technologies to enhance education while addressing the challenges and concerns that have been identified.

Conclusion

This detailed methodology ensures a rigorous and systematic approach to exploring how AI is being integrated into Saudi educational settings from the perspective of the educators themselves. The constructivist grounded theory approach allows for the development of a theory grounded in the lived experiences of educators, which can provide valuable insights for policymakers, curriculum developers, and educational technologists.

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