JOURNAL OF ASSOCIATION OF EDUCATIONAL MANAGEMENT AND POLICY PRACTITIONERS

(JAEMPP)
https://journals.aemapp.org/
Volume 4 Issue 1, 2024

APPLICATION OF AI IN EDUCATIONAL LEADERSHIP RESEARCH AND INNOVATION IN SUB-SAHARAN AFRICA

Juliana Nkechi Odoh (Ph.D)[1]
nj.odoh@unizik.edu.ng,jullyodoh@gmail.com.
Educational Management and Policy. Faculty of Education.
Nnamdi Azikiwe University Awka.

Dr. Victoria Chimezie Mbonu[2]
Educational Management and Policy, Faculty of Education.
Nnamdi Azikiwe University Awka. Anambra State
vc.mbonu@unizik.edu.ng.

Dr. Bibian Nkechinyere Nwokwu[3]
Public Administration, Faculty of Management Sciences Ebonyi State University, Abakaliki, Ebonyi State.
bibian.nwokwu@ebsu.edu.ng,bibiannwokwu@gmail.com

Abstract

The application of AI in educational leadership research and innovation in Sub-Saharan Africa has been gaining immense attention in recent years. With the growing demand for effective and efficient educational systems in the region, the potential of AI to revolutionize the field of education has been widely recognized. This paper explores the various ways in which AI has been applied in educational leadership research and innovation in Sub-Saharan Africa. One of the main areas of focus has been using AI to improve educational outcomes for students. By analyzing large datasets, AI algorithms are able to identify patterns and trends in student learning and performance. This allows for the development of personalized learning plans and targeted interventions that cater to the specific needs of each student. Additionally, AI-powered virtual assistants have been developed to support and guide students in their learning journey. Another key application of AI in educational leadership research and innovation is in curriculum development. Traditional curriculum design methods often lack the ability to adapt and keep up with the rapidly changing needs of students. With the use of AI, curriculum can be continuously evaluated and updated to ensure relevance and effectiveness. Furthermore, AI can assist in identifying gaps and biases in existing curriculum, leading to a more inclusive and diverse education system. AI is also playing a crucial role in teacher training and support. By analyzing data from classroom observations and student feedback, AI can provide personalized coaching and feedback to teachers, helping them improve their instructional practices. This not only

benefits the teachers but also has a positive impact on student learning outcomes. Finally, AI is being utilized in educational leadership research to provide insights and recommendations for policy-making and decision-making. By processing and analyzing data from various sources, AI can identify key areas for improvement and suggest evidence-based solutions. The application of AI in educational leadership research and innovation in Sub-Saharan Africa has the potential to greatly enhance the quality and effectiveness of education in the region. As technology continues to advance, it is crucial for educational leaders to embrace and utilize AI as a powerful tool for driving positive change in the education sector.

Keywords: Artificial Intelligence (AI), Educational Leadership, Educational Research,Innovation in Education and Sub-Saharan Africa

INTRODUCTION

The integration of Artificial Intelligence (AI) into various sectors of society has led to transformative changes, especially in education. AI's application in educational leadership and research has brought new opportunities to advance teaching, learning, and administrative practices. In Sub-Saharan Africa, where education systems face unique challenges such as resource constraints, infrastructure issues, and a rapidly growing population, AI offers potential solutions to enhance educational leadership, research, and innovation. The focus on AI's role in educational leadership research and innovation in this region highlights the ways in which emerging technologies can revolutionize traditional educational models, improve access to quality education, and address the diverse needs of students and educators alike.

AI is broadly understood as the simulation of human intelligence processes by machines, especially computer systems (Russell & Norvig, 2016). These processes include learning, reasoning, problem-solving, and language understanding, among others. AI's capabilities make it highly relevant to educational leadership, particularly in the context of improving educational quality, increasing efficiency in management, and fostering innovation in teaching methods. The transformative potential of AI in education is evident through various applications such as personalized learning, predictive analytics, and administrative automation. In the context of Sub-Saharan Africa, AI presents both challenges and opportunities, requiring a thoughtful integration that takes into account the region's socio-economic realities.

AI in Educational Leadership

Educational leadership refers to the practices and policies that guide schools and educational systems to achieve their goals of providing high-quality education. In Sub-Saharan Africa, educational leadership has been challenged by factors such as inadequate funding, lack of professional

development for leaders, and complex socio-political environments. AI has the potential to address some of these challenges by providing tools that enhance the capacity of educational leaders to make informed decisions, streamline administrative functions, and create more personalized learning environments for students.

One key area where AI can impact educational leadership is in data-driven decision-making. AI-powered analytics tools can help educational leaders make better decisions by providing real-time data on student performance, attendance, and engagement. These tools can identify trends and patterns that may not be visible through traditional data analysis methods, enabling leaders to take proactive steps to address potential issues before they become systemic problems (Nguyen et al., 2020). For instance, AI can help predict student dropouts or underperformance and suggest targeted interventions, such as tailored instructional approaches or additional support services.

Moreover, AI can improve leadership capacity through its role in professional development. AI-driven platforms can be used to provide customized training for educational leaders, enabling them to enhance their skills in areas such as management, pedagogy, and policy implementation. These platforms can also facilitate the sharing of best practices and knowledge among leaders, fostering a more collaborative and innovative approach to educational governance (Zawacki-Richter et al., 2019). For Sub-Saharan Africa, where educational leaders often face significant barriers in accessing formal training opportunities, AI could play a crucial role in bridging these gaps.

Personalized Learning: An Overview and Application in Education

Personalized learning refers to a tailored educational approach that is designed to meet the individual needs, interests, and learning styles of students. Unlike traditional one-size-fits-all teaching methods, personalized learning recognizes that students vary in how they learn and progress, and it strives to provide learning experiences that accommodate these differences. This approach empowers students to take control of their learning, with the support of educators who guide them in their journey. Personalized learning can take many forms, ranging from adaptive learning technologies to differentiated instructional strategies, and it is increasingly being supported by emerging technologies, including Artificial Intelligence (AI).

Key Principles of Personalized Learning

1. **Learner-Centered Approach**: The focus of personalized learning is on the learner rather than the curriculum or teaching methods. It acknowledges that each student has unique strengths, weaknesses, preferences, and prior knowledge, which should be considered when designing learning experiences.

2. **Pace of Learning**: Personalized learning allows students to progress at their own pace, moving forward when they demonstrate mastery of a concept and spending more time on areas where they struggle. This flexibility ensures that students can fully grasp the material before advancing, rather than being pushed along with the rest of the class.
3. **Customization of Learning Paths**: In a personalized learning environment, students may have different learning paths or trajectories based on their individual needs. This could include choices in the subjects they study, the projects they undertake, or the tools and resources they use. Technology, such as AI-powered platforms, can assist in guiding students along their personalized learning journeys.
4. **Use of Technology**: Technology plays a crucial role in facilitating personalized learning by providing access to resources, tools, and platforms that can adapt to individual learning needs. AI-driven educational tools can analyze students' learning behaviors, provide tailored content, and offer real-time feedback. These platforms create dynamic learning environments that adjust in real time based on student performance.
5. **Student Autonomy**: Personalized learning encourages students to take ownership of their learning. This approach often involves goal-setting, self-assessment, and reflection. Students are empowered to make decisions about what and how they learn, increasing their engagement and motivation.

AI's Role in Personalized Learning

AI is transforming personalized learning by offering tools and platforms that can adapt to the needs of individual students. These tools use machine learning algorithms to analyze data such as test scores, engagement levels, and learning behaviors, allowing them to predict what content or teaching methods will be most effective for each student.

1. **Adaptive Learning Platforms**: One of the most significant applications of AI in personalized learning is the development of adaptive learning systems. These systems adjust the difficulty of content and the sequence of lessons based on a student's performance. For example, if a student struggles with a particular math concept, the system may present additional practice problems or provide a simplified explanation until mastery is achieved.
2. **Learning Analytics**: AI can track and analyze a vast array of student data to provide real-time insights into their progress. By continuously monitoring students' interactions with learning materials, AI can identify areas where they may need

more support and suggest targeted interventions. Educators can use these insights to offer personalized guidance and adjust their teaching strategies.

3. **Personalized Feedback**: Immediate and personalized feedback is an essential component of personalized learning. AI can provide detailed feedback on assignments, quizzes, and activities, highlighting areas for improvement and offering specific recommendations for further study. This feedback can be automated, allowing students to receive it promptly, even outside of class time.
4. **Learning Pathways**: AI-powered tools can generate personalized learning pathways for students, suggesting activities, resources, and lessons tailored to their individual needs. These pathways can be adjusted in real-time as students make progress, ensuring that they are always working on material that challenges them at an appropriate level.
5. **Gamification and Engagement**: AI can also enhance student engagement by incorporating gamified elements into the learning experience. AI-driven systems can adjust the level of difficulty in games, challenges, or simulations to match the student's ability, making the experience both engaging and educational.

Personalized Learning in Sub-Saharan Africa

The application of personalized learning, particularly through AI, has the potential to significantly impact education in Sub-Saharan Africa. The region faces numerous educational challenges, such as large class sizes, limited access to quality educational resources, and teacher shortages. Personalized learning, powered by AI, can help address these issues by offering more tailored educational experiences, even in resource-constrained environments.

1. **Bridging Educational Gaps**: AI-powered personalized learning platforms can help bridge the educational gaps in Sub-Saharan Africa by providing students with individualized instruction that may not otherwise be available due to large class sizes or teacher shortages. Students in rural or underserved areas, where access to qualified teachers is limited, can benefit from AI-driven platforms that offer adaptive learning and feedback.
2. **Scalable and Accessible Education**: AI tools can be scaled to reach a larger number of students, even in remote areas. Through mobile apps or online platforms, personalized learning can be delivered to students with varying levels of access to infrastructure. This scalability allows education to be more inclusive and accessible, helping to address disparities in the education system.
3. **Improving Teacher Support**: In regions where teachers may lack adequate training or resources, AI

can provide support by suggesting personalized teaching strategies and resources. Teachers can use AI-driven analytics to monitor their students' progress and adjust their instructional methods to meet the individual needs of each student.

4. **Fostering Student Autonomy**: Personalized learning encourages self-directed learning, a skill that is especially valuable in Sub-Saharan Africa, where many students face challenges related to the formal education system. With AI, students can take greater ownership of their learning, setting their own goals and progressing at their own pace, which can enhance motivation and academic outcomes.

Challenges and Considerations

While the potential benefits of personalized learning through AI are significant, several challenges must be addressed, particularly in Sub-Saharan Africa:

1. **Digital Divide**: Access to technology and reliable internet is a major concern in Sub-Saharan Africa. Many students and schools lack the infrastructure needed to support AI-powered personalized learning tools. Investments in technology infrastructure, such as improved internet connectivity and affordable devices, are essential for the successful implementation of personalized learning.
2. **Teacher Training**: For AI-driven personalized learning to be effective, teachers must be adequately trained to use these tools. In many parts of Sub-Saharan Africa, teachers may lack the digital literacy skills necessary to integrate AI tools into their teaching practices. Professional development programs focusing on the use of AI in education can help bridge this gap.
3. **Data Privacy and Security**: The use of AI in personalized learning requires the collection and analysis of large amounts of student data. It is crucial to ensure that this data is handled ethically and securely, protecting students' privacy and ensuring compliance with data protection regulations.
4. **Cultural and Linguistic Considerations**: Personalized learning tools should be culturally relevant and adaptable to the diverse linguistic and cultural contexts found across Sub-Saharan Africa. AI systems must be designed to accommodate various languages and learning styles to ensure inclusivity.

Conclusion

Personalized learning represents a promising evolution in educational practices, offering students the opportunity to learn at their own pace, according to their unique needs. AI plays a central role in making personalized learning scalable, adaptive, and efficient. In Sub-Saharan Africa, AI-powered

personalized learning has the potential to address significant educational challenges, from large class sizes to limited access to qualified teachers. However, successful implementation requires overcoming challenges related to infrastructure, teacher training, and data privacy. With the right investments and support, personalized learning can transform education in Sub-Saharan Africa, providing students with more equitable and engaging learning experiences.

AI in Educational Research

Educational research in Sub-Saharan Africa has historically been hindered by limitations such as insufficient data, lack of infrastructure, and inadequate research funding. However, AI's application in educational research can significantly enhance data collection, analysis, and dissemination. Through the use of AI tools, researchers can gain more accurate insights into the effectiveness of educational programs, identify factors influencing student success or failure, and explore innovative educational practices in real-time.

One notable example of AI's application in educational research is in the area of learning analytics. AI algorithms can analyze vast amounts of data generated by students' interactions with digital learning platforms, helping researchers identify patterns in student engagement, learning behaviors, and academic achievement (Siemens, 2013). This type of data-driven research can be instrumental in designing more effective curricula and teaching strategies that are tailored to the needs of diverse student populations in Sub-Saharan Africa.

Furthermore, AI can assist in qualitative research by automating data collection and analysis, particularly in large-scale studies that require the processing of interviews, surveys, or open-ended responses. Natural language processing (NLP) technologies can help researchers analyze text data efficiently, allowing for the extraction of insights from diverse sources, such as student feedback or educational policy documents (Choudhury et al., 2021). This capability is especially beneficial in Sub-Saharan Africa, where access to research funding and resources is often limited, and large-scale data analysis may otherwise be prohibitively expensive.

AI in Innovation in Education

Innovation in education is essential for ensuring that teaching and learning remain relevant in an ever-changing world. AI's ability to foster innovation in education lies in its capacity to personalize learning, automate administrative tasks, and provide students with interactive and engaging learning experiences. In Sub-Saharan Africa, where challenges such as overcrowded classrooms, limited access to educational materials, and teacher shortages are prevalent, AI offers innovative solutions that can address these issues.

Personalized learning, made possible by AI, allows educators to tailor instruction to the individual needs of students, adapting to their learning pace, preferences, and abilities. For example, AI-driven learning platforms can assess a student's strengths and weaknesses and provide customized content to help them progress at their own pace (Luckin et al., 2016). This is particularly important in Sub-Saharan Africa, where diverse learning needs and large class sizes often make it difficult for teachers to give individualized attention to students. AI can thus enable teachers to better address the learning gaps and provide more equitable education.

Moreover, AI can be used to innovate assessment methods. Traditional exams and grading systems often fail to capture the full range of student learning outcomes. AI-powered assessments, on the other hand, can provide more comprehensive evaluations by considering factors such as critical thinking, creativity, and problem-solving abilities (Holmes et al., 2019). These innovations can lead to a more holistic understanding of student progress and contribute to the development of new pedagogical approaches that better align with the needs of 21st-century learners.

Data-Driven Decision Making in Education: A Key to Enhanced Educational Leadership and Outcomes

Data-driven decision making (DDDM) refers to the process of making decisions based on the analysis of data rather than intuition or personal experience. In education, DDDM involves the systematic use of data from multiple sources—such as student assessments, surveys, classroom observations, and administrative records—to inform decisions about teaching, learning, and resource allocation. The growing availability of digital tools and the increasing emphasis on data collection in educational systems have made DDDM a critical component in improving educational leadership and enhancing student outcomes.

In the context of educational leadership, data-driven decision making provides school leaders, administrators, and policymakers with the insights needed to create evidence-based strategies for improving the quality of education. It allows leaders to assess the effectiveness of teaching methods, monitor student progress, identify achievement gaps, and implement targeted interventions. With the rise of technology, including Artificial Intelligence (AI) and Learning Analytics, DDDM has become even more powerful by allowing educators and leaders to analyze vast amounts of data in real-time, yielding more accurate insights and enabling faster decision-making processes.

Key Components of Data-Driven Decision Making

1. **Data Collection**: Effective data-driven decision making begins with the collection of reliable and relevant data. In education, this data can come from various sources, such as student test scores, attendance

records, behavior tracking systems, surveys, and teacher assessments. Digital platforms and educational technologies have made it easier to gather large volumes of data on student learning and performance.

2. **Data Analysis**: Once the data is collected, it must be analyzed to derive meaningful insights. This process often involves the use of statistical tools and software that can process large datasets and identify patterns, trends, and correlations. Data analysis can help educational leaders assess overall student performance, monitor individual student progress, and pinpoint areas where interventions may be needed.
3. **Data Interpretation**: Data alone is not useful unless it is properly interpreted. Educational leaders must have the knowledge and expertise to interpret the results of data analysis and make informed decisions. For example, if data reveals a decline in student performance in a particular subject, educational leaders must investigate the root causes and use this information to guide decision-making.
4. **Implementation of Decisions**: After interpreting the data, educational leaders must make decisions based on the insights gathered. These decisions can range from altering curriculum designs, providing professional development opportunities for teachers, adjusting teaching strategies, or allocating resources more effectively. The key is to implement evidence-based practices that can improve educational outcomes.
5. **Continuous Monitoring and Evaluation**: Data-driven decision making is not a one-time event; it is a continuous cycle. After implementing decisions, it is essential to collect new data and evaluate the effectiveness of the changes. This allows leaders to refine their strategies, track progress, and ensure that the goals are being met.

The Role of Data-Driven Decision Making in Educational Leadership

Educational leadership is fundamentally concerned with creating a vision for the future of a school or educational system, setting goals, and making decisions that ensure the success of students and teachers. Data-driven decision making plays a crucial role in supporting these efforts by providing evidence that guides strategic decisions. Key areas where DDDM supports educational leadership include:

1. **Improving Student Outcomes**: By analyzing student performance data, educational leaders can identify trends and potential barriers to learning. For example, data analysis might reveal that students from a particular demographic group are underperforming. Educational leaders can then develop targeted

strategies, such as tutoring programs or differentiated instructional approaches, to help these students succeed.

2. **Resource Allocation**: DDDM helps school leaders make more informed decisions about how to allocate resources effectively. By using data to understand which programs, courses, or interventions are most successful, leaders can direct funding to the areas where it will have the greatest impact. For instance, if data shows that a particular type of professional development leads to improved teacher effectiveness, it can be prioritized in the budget.
3. **Curriculum and Instruction**: Data-driven decision making allows educators to adjust their curricula and teaching methods to better meet the needs of their students. By regularly analyzing assessment data, teachers can identify which topics students are struggling with and modify their instructional strategies accordingly. This creates a dynamic learning environment where teaching methods evolve based on student needs.
4. **Early Identification of At-Risk Students**: One of the most powerful applications of data-driven decision making is its ability to identify students who are at risk of falling behind or dropping out. By analyzing data such as attendance patterns, grades, and behavioral issues, educators can identify warning signs early and implement interventions to provide additional support. Early identification and intervention are key to improving student retention and reducing achievement gaps.
5. **Professional Development for Teachers**: Data can also inform the professional development needs of educators. By analyzing student outcomes and classroom performance data, school leaders can identify areas where teachers may need additional training or support. This could include anything from classroom management strategies to using technology in the classroom.

Data-Driven Decision Making in Sub-Saharan Africa

In Sub-Saharan Africa, where education systems face unique challenges such as resource scarcity, limited access to technology, and large student populations, data-driven decision making presents a promising solution for improving educational outcomes. By leveraging data, educational leaders in the region can make more informed decisions that can drive systemic improvements in teaching and learning.

1. **Addressing Educational Inequities**: Data-driven decision making can help identify disparities in education outcomes in Sub-Saharan Africa. For example, data might reveal that certain regions or student groups are consistently

underperforming. Educational leaders can use this data to implement policies aimed at closing the achievement gap, such as targeted interventions for underperforming schools or communities.

2. **Improving Teacher Quality**: In many parts of Sub-Saharan Africa, there is a shortage of qualified teachers, and teacher training is often inadequate. DDDM can help identify areas where teachers need professional development, such as classroom management skills, teaching techniques, or subject matter knowledge. By collecting and analyzing data on teacher performance, school leaders can better support their teachers and improve instructional quality.
3. **Optimizing Resource Allocation**: With limited resources, educational leaders in Sub-Saharan Africa need to make strategic decisions about how to allocate funding and materials. DDDM can help identify which programs or resources are most effective, enabling leaders to prioritize investments that will have the greatest impact on student learning.
4. **Improving Student Engagement**: Data-driven decision making can also be used to improve student engagement, which is often a challenge in Sub-Saharan Africa due to factors like overcrowded classrooms and lack of access to materials. By analyzing attendance, participation, and performance data, educational leaders can identify strategies that improve student engagement, such as the integration of more interactive teaching methods or the use of technology to enhance learning experiences.
5. **Monitoring and Accountability**: In many educational systems in Sub-Saharan Africa, accountability for student outcomes can be limited. DDDM can be used to hold educators and administrators accountable for student performance. By setting data-driven benchmarks and regularly monitoring progress, leaders can ensure that schools are meeting their goals and making continuous improvements.

Challenges of Data-Driven Decision Making in Sub-Saharan Africa

While the potential benefits of data-driven decision making are significant, there are several challenges to its effective implementation in Sub-Saharan Africa. These include:

1. **Limited Access to Technology**: Many schools in Sub-Saharan Africa lack the necessary infrastructure, such as reliable internet access, computers, and other technological tools, to collect and analyze data effectively. Without the proper technology, DDDM cannot be fully realized.

2. **Data Quality and Reliability**: The accuracy and reliability of data collected in Sub-Saharan Africa can be a challenge. In some cases, data may be incomplete, outdated, or inaccurately recorded, which can undermine decision-making processes.
3. **Capacity Building**: School leaders, teachers, and administrators in Sub-Saharan Africa may lack the skills and training required to interpret and use data effectively. Professional development programs are necessary to build the capacity of educators to leverage data for decision making.
4. **Cultural and Systemic Barriers**: In some regions, there may be cultural or systemic barriers to adopting data-driven practices. For example, educational leaders may be accustomed to traditional decision-making methods based on experience and intuition, which can hinder the adoption of a more data-centric approach.

Conclusion

Data-driven decision making is a powerful tool for educational leadership, as it allows leaders to make informed, evidence-based decisions that can improve student outcomes and optimize resource allocation. In Sub-Saharan Africa, where educational systems face significant challenges, DDDM holds the potential to drive meaningful reforms that enhance the quality of education and address disparities in access and achievement. By investing in the necessary infrastructure, training, and systems to support data collection and analysis, educational leaders in the region can make smarter, more effective decisions that benefit students, teachers, and schools.

Challenges and Opportunities in Sub-Saharan Africa

While the potential benefits of AI in educational leadership, research, and innovation in Sub-Saharan Africa are significant, the region faces several challenges that must be addressed for successful AI integration. These challenges include limited internet access, low digital literacy, and insufficient infrastructure. To overcome these obstacles, investments in technology infrastructure, teacher training, and policy frameworks are essential to ensure that AI can be implemented effectively and equitably.

In conclusion, AI holds tremendous promise for enhancing educational leadership, research, and innovation in Sub-Saharan Africa. By enabling data-driven decision-making, personalized learning, and innovative research methodologies, AI has the potential to address many of the educational challenges faced by the region. However, for AI to be successfully integrated into educational systems, it is crucial to ensure that the necessary infrastructure, policies, and training programs are in place to support its use. With strategic planning and collaboration, AI can play a pivotal role in transforming

education in Sub-Saharan Africa, providing students, educators, and leaders with the tools they need to navigate the complexities of the 21st century.

References

Agasisti, T., & De Angeli, D. (2017). The role of data in the assessment of school performance: Data-driven decision-making in education. *Research in Education Policy and Management, 9*(1), 1-16.

Choudhury, S., Sarker, A., & Roy, S. (2021). Artificial intelligence in education: Applications, trends, and challenges. *AI Open, 2*(1), 1-12. https://doi.org/10.1016/j.aiopen.2021.02.004

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education.

Mandinach, E. B., & Gummer, E. S. (2013). A theoretical framework for data-driven decision making. *Yearbook of the National Society for the Study of Education, 112*(2), 13-34. https://doi.org/10.1111/j.1744-7984.2013.01164.x

Nguyen, T., Zhang, K., & Weng, M. (2020). Leveraging artificial intelligence for educational leadership. *Journal of Educational Technology & Society, 23*(4), 89-103.

Russell, S., & Norvig, P. (2016). *Artificial intelligence: A modern approach* (3rd ed.). Pearson Education.

Siemens, G. (2013). Learning analytics: The emergence of a discipline. *American Behavioral Scientist, 57*(10), 1409-1416. https://doi.org/10.1177/0002764213490714

Wayman, J. C., & Cho, V. (2009). Data-driven decision-making in education. *Yearbook of the National Society for the Study of Education, 108*(2), 1-24. https://doi.org/10.1111/j.1744-7984.2009.01131.x

Zawacki-Richter, O., Baecker, E. M., & Vogt, S. (2019). *Systematic review of research on AI in education*. Springer.