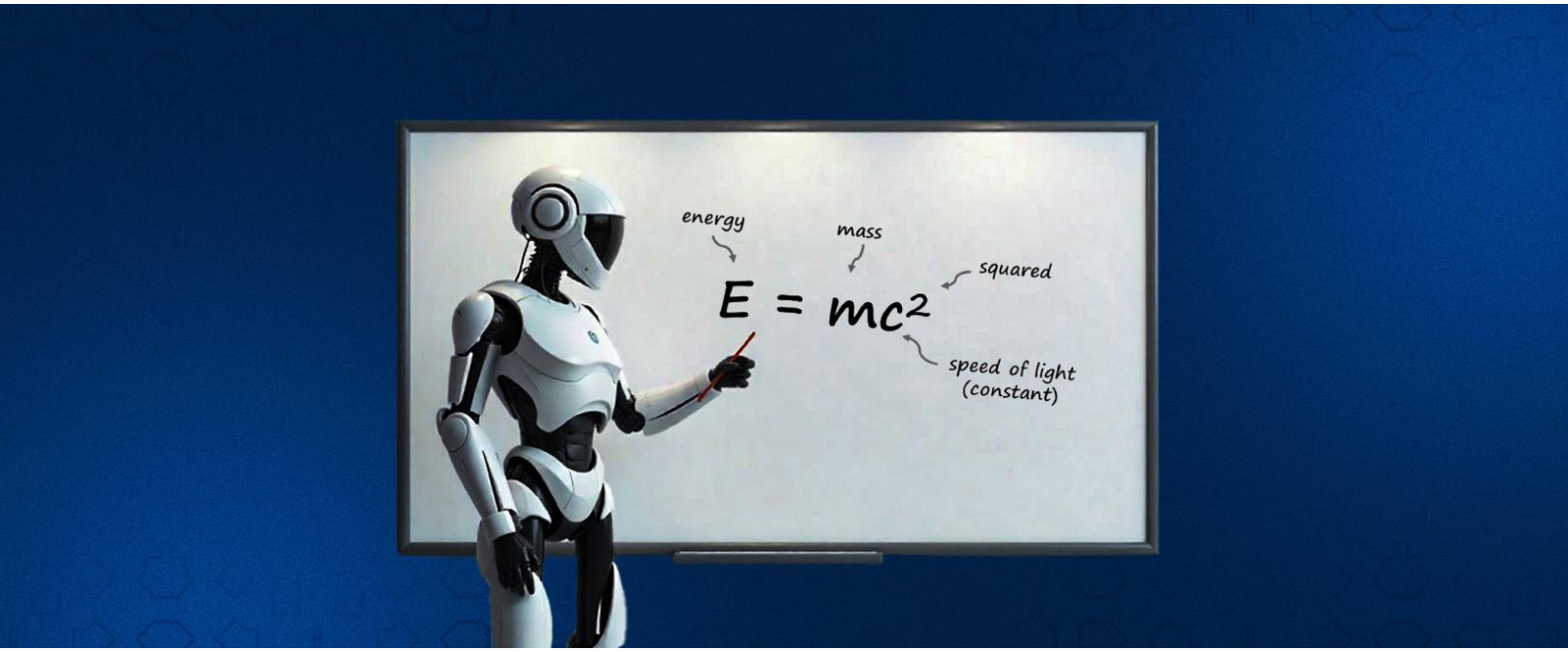
EXPLORING AI-DRIVEN SOLUTIONS FOR CHALLENGES FACING KRI'S EDUCATION SYSTEM

Soleen Soran | March 17, 2025



Executive Summary

Artificial Intelligence (AI) technology has the potential to revolutionize education by providing students with the technological skills needed to thrive in the market economy. The current state of education in the Kurdistan Region of Iraq (KRI) faces several challenges, including overcrowded classrooms, poor infrastructure, an outdated education framework, and a lack of support for teachers. To address these issues, the Kurdistan Regional Government (KRG) needs to explore AI-supported technologies that could help enhance the education system. AI can create a highly personalized learning experience for the student and assist teachers with managing their classrooms without requiring excessive resources, ultimately enhancing the quality of education. By learning from successful case studies and implementing key recommendations, the KRI can effectively integrate AI to strengthen its education system while addressing existing challenges.

Introduction

Education is a fundamental building block of our society; every individual has the right to receive education to better contribute to their community. Traditional standards of schooling have existed since the foundation of civilization and have maintained a rigid and well-established system, which is why introducing a new and unpredictable technology with the promise of revolutionizing the system can be hard to accept.

While intelligent tutoring systems have existed for the past 50 years, the recent introduction of artificial intelligence represents a significant transformation in the way education is delivered.[1] AI is a computer system that is built and designed to digest substantial amounts of data and identify patterns while following detailed instructions from the sets of data it uses in the background. It has the ability to reason, analyze, create, and learn from experience in ways that have become very similar to human learning.

In the last few years, AI has been transforming lives in different fields and has the potential to reform education as well. With its potential in advancing our approach to teaching and learning, AI has been making waves globally, prompting public and private sectors to explore its transformative potential.[2] The development of AI will lead to more jobs that will require a lot of technical skills. Integrating AI into the KRI's education system can equip the next generation of the workforce with essential technological skills. This will help them succeed in a globalized world and contribute to economic growth in the region. This is especially important given that, according to the 2024 Iraq census, 31.86% of KRI's population is between the ages of 0-14, forming a promising future labor force.[3] This study aims to examine the current state of education in the KRI and explore AI technologies that could help revolutionize the system.

Existing Problems in the Education System in KRI

In the KRI, alongside private institutions, three ministries oversee education. The Ministry of Education takes care of basic and secondary schooling, including vocational (career-focused) learning. The Ministry of Higher Education and Scientific Research is responsible for universities, technical institutes, and postgraduate studies. The Ministry of Labor and Social Affairs runs adult training programs after high school.[4] The KRI's education system primarily teaches students in Kurdish, while also teaching English and Arabic as additional languages. However, private schools teach in English with a more advanced English-language curriculum.

It is important to highlight the challenges the education system faces, including the following:

1. Overcrowded classrooms: There are not enough teachers and schools to accommodate the rising number of students, leading to overcrowded classrooms, creating an inadequate learning environment.
2. Poor infrastructure: Many schools struggle with outdated and deteriorating buildings, as well as a lack of space designated for extracurricular activities.
3. Outdated education framework that does not follow international standards: The system has a standardized mathematics and science curriculum across the region for both public and private schools. The goal of this standardization was to promote equality among students in all public and private schools. However, this has created a rigid and outdated education framework that does not follow international standards nor allow international assessments of the system.[5]
4. Lack of support for teachers: Educators face numerous challenges, including inadequate teacher training programs, unfair monetary compensation, overwhelming workloads, and having to teach subjects outside their area of specialization due to insufficient preparation and a growing number of students.[6]
5. Standardized tests that focus on memorization: A flawed feature of the system, favoring testing the student's memory rather than testing their intelligence.[7]
6. Neglecting Liberal Arts: There is a disproportionate focus on fields like medicine and engineering, while other fields such as the humanities, social sciences, languages, natural sciences, and the arts are largely overlooked by both the educational system and the public. As a result, the vital role and importance of these fields in society are often overlooked.
7. Unequal advantages for the wealthy: Private schools, institutes, and universities have become a necessity.[8] As of 2023, out of the 48 universities and institutes in the Kurdistan Region, 18 are public and 30 are private.[9] This has created unfair

advantages for students from wealthier backgrounds, limiting future opportunities for those from less privileged backgrounds.

8. Issue of employment opportunities for recently graduated students: Many fresh graduates face significant challenges in securing employment despite having earned degrees.
9. The temporary closure of schools due to Covid-19 quarantines and teacher strikes: During periods of school closures caused by quarantines and frequent teacher strikes due to late or unpaid wages, the KRI education system struggles to adapt to online learning because of a lack of technological experts and infrastructure. As a result, extended closures lead to significant disruptions in education, creating gaps in students' learning and hindering their academic progress.

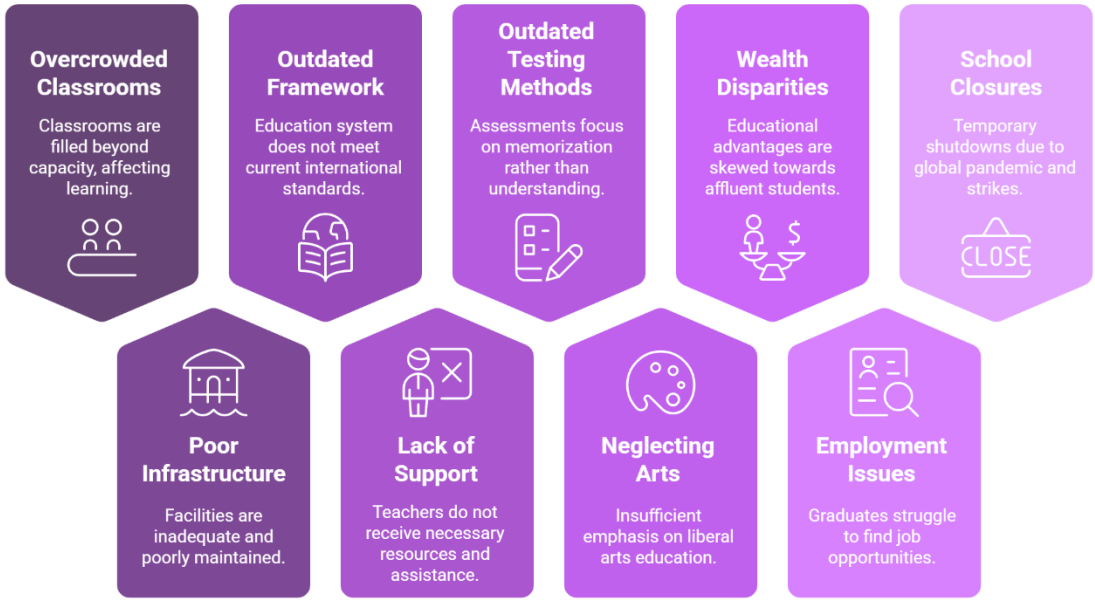


Figure 1: Key Challenges in Kurdistan's Education System

The Case for AI in Education

Historically, there has always been a digital skill gap between developed and developing countries. However, AI has the potential to bridge this gap, thanks to the widespread adoption

of the internet and smartphones in the Global South over the past few decades. By integrating AI into education, these regions have a unique opportunity to modernize their outdated systems and enhance digital literacy.[10]

AI has the potential to resolve many of the problems in KRI's education system. It can act as a personalized private teacher for each student, adapting to their unique learning patterns and struggles while continuously improving through the data it receives and the experiences it processes. AI follows instructions while also thinking of ways to optimize its approach for higher efficiency. This creates a highly personalized learning experience for the student without requiring excessive resources, ultimately enhancing the quality of education. Some fear that AI will replace teachers in the future, but AI's job is not to replace but to support; it can enhance the learning experience while assisting teachers, leading to a more optimized educational environment for all parties.[11] There are certain human-teacher interactions that AI can't replace; there are instances where a student needs a role model or real-life support that requires a teacher, which is why teachers are irreplaceable.

Whether AI's role is acknowledged or not, its presence is clear. 43% of American college students admit to using AI tools such as ChatGPT, users have reported a 62% improvement in exam grades, as well as a 30% in class performance and a 20% reduction in school-related stress.

Innovative Applications of AI in Education

There have been many inventions in AI systems used in education over the last decade; they all come in various formats, each designed to address specific challenges and improve different aspects of learning and school administration. These systems use advanced algorithms to enhance student engagement, support educators, and optimize educational circulars.[12] Researchers have identified several key types of AI applications that are transforming education today, as explained below and shown in Figure 2.

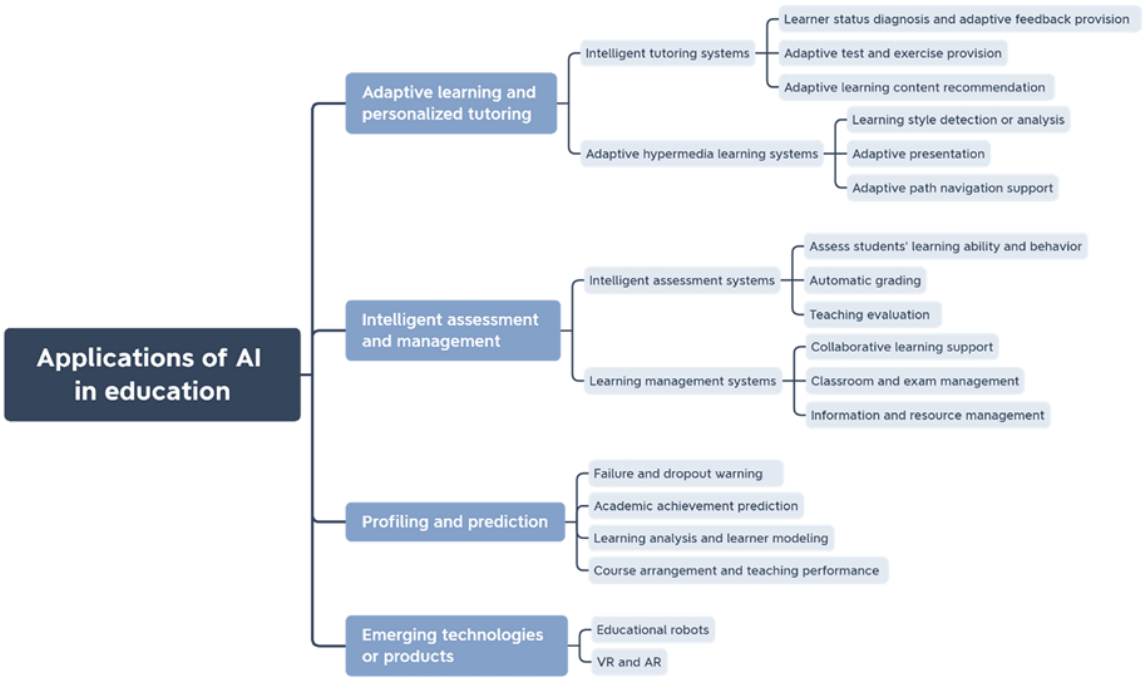


Figure 2: Potential Applications of AI Systems in Education – Source: ELSEVIER

1. **Adaptive learning and personalized tutoring:** In this type of incorporation of AI in education, the AI system works by customizing its teaching methods to an individual's preference by analyzing their learning style, education level, and interests. For example, *intelligent tutoring systems* are AI tutors that are designed to adapt to a student's learning style and offer answers and instructions to said students that best suit their learning style. This system consists of features such as student progress monitoring and problems diagnosis, adaptive testing and feedback delivery, as well as personalized content recommendations upon request.[13] Another example is *adaptive hypermedia learning systems*, where the AI system analyzes a student's learning pattern to create educational materials tailored to that student's preferences. This approach builds the educational curriculum around each individual student as the focus; the system is also designed to consistently adjust the materials as they learn more about the student.[14]

2. **Intelligent assessment and management:** This AI system is great for assisting teachers in managing their students. It works by tracking and recording students' progress through the school year while offering evaluations to the teachers. It also provides services such as test grading and administration work to lessen the workload faced by teachers, who can then focus their efforts on teaching the students.[15] This AI system can be utilized in two ways: *intelligent assessment systems,* where the system tracks and records students' progress, and *learning management systems,* where the system manages all the teacher's administrative work.[16]
3. **Profiling and prediction:** This system's job is to analyze a student's weaknesses and strengths, and predict the likelihood of them failing a test or a subject at the beginning of the school year, which can help prepare the student and the teacher to avoid such outcomes by giving the student more resources in the topic they are likely to fail and to give the teachers ample time to focus on the student. It also works in the opposite direction; by giving predictions on which students are academically gifted in what subjects and classes; this can give students an insight into what fields to pursue in the future.[17]
4. **Emerging technologies or products:** Alongside the mentioned above emerging AI systems, there are also technological products that utilize AI that can help enhance students' education. For instance, virtual reality and augmented reality work by creating a virtual world that offers experiences that cannot be replicated in real life.[18] They can work by recreating popular museums the students can explore right in their classroom or recreating the inside of a cell to see the functions they study about with their own eyes, making grasping complicated and vague concepts easier to understand. Another popular emerging product is educator robots, these are moving robots equipped with chatbots to interact with students in a way that feels as close to a person as possible, offering help and support whenever needed.

Success Case Studies in Other Countries

While there is excitement about AI's potential for global educational development, solid confirmation data is still limited and ambiguous. There are also concerns about AI's risks. Discussions on AI's impact and responsibility are often broad and abstract which is why looking at real-world practices in different regions can be more insightful.[19] Below are some case studies of AI used in education applied in other countries.

1. Kwame for Science in West Africa:

Kwame for Science is an AI-powered, smartphone-run web application that helps students across West Africa study and revise science subjects using their phones. It functions as an AI tutor, answering students' questions and explaining the answers in both English and French. It covers an assortment of science subjects, including physics, biology, chemistry, geology, and agriculture.[20]

One of the first challenges Kwame's developers faced was obtaining trusted resources to include in the app. They were unable to collaborate with local textbook publishers due to copyright concerns, as publishers feared their textbooks would be illegally copied and sold at lower prices. Additionally, national exam materials were only available in hard copy, and no official answers were available, creating another obstacle—manually inputting 28 years' worth of test information into their data system. To address this, the developers decided to hire local experts to provide answers to previous national exams and incorporated an international open-source science textbook as additional data.[21]

Another issue the developers had to consider was the limited internet access available to many students. To mitigate this, the app uses simplified lesson notes designed for offline reading when users are disconnected, helping to reduce data usage.

Kwame for Science includes several key features. The "View Past Questions" feature allows students to access previous national exam questions and answers for revision for their own

upcoming exams. Additionally, the app includes an auto-grading function which is an automated grading software that not only evaluates tests and assignments but also checks for plagiarism.[22]

During its first beta launch, from June 10, 2022, to February 19, 2023, Kwame gained 750 users from 32 countries worldwide (15 in Africa). A total of 1,500 questions were asked, and through the feedback function, 72.6% of users rated their answers as very helpful. The app also received an 87.2% accuracy rating for its responses.[23]

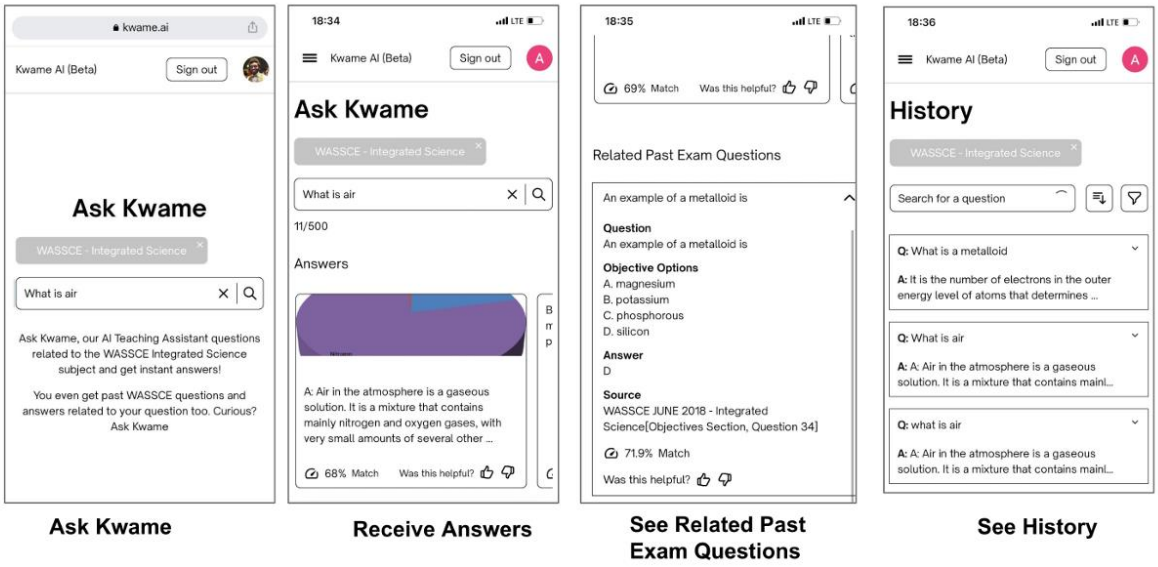


Figure 3: Screenshots of the Kwame app (Ask Kwame) feature – Source: Springer

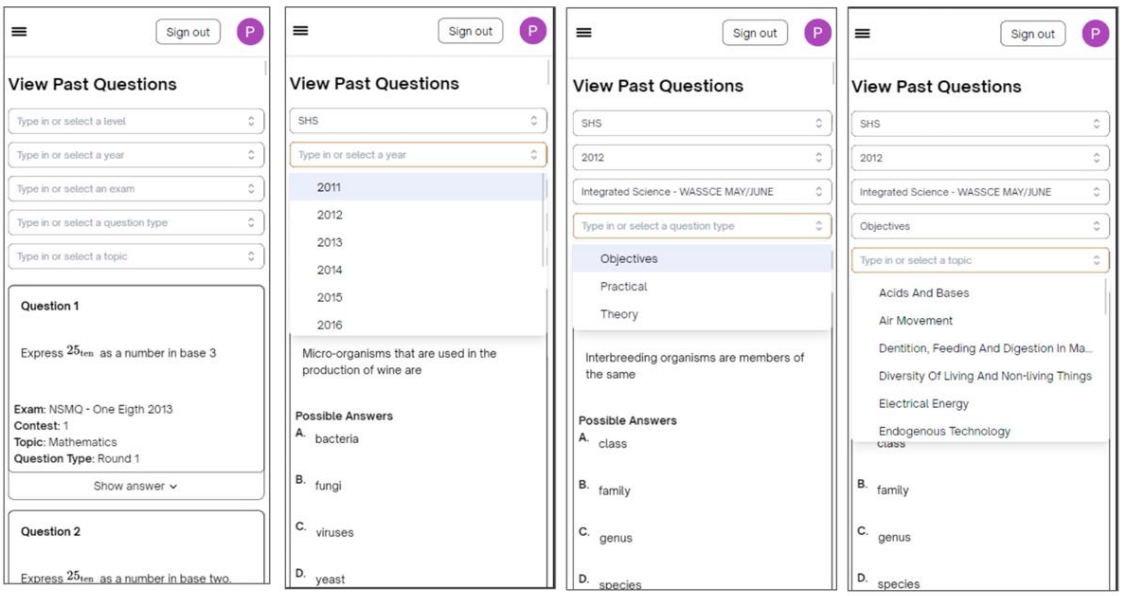


Figure 4: Screenshots of the Kwame app (View Past Questions) feature – Source: Springer

2. The Teacher AI in Sierra Leone:

The Teacher AI is an AI-powered chatbot developed to assist teachers by providing on-demand support and training through interactive conversations, offering information and answering questions in real time. The developers of The Teacher AI recognized the important role of teachers in the education system and the lack of support both in training development and classroom assistance, which is exacerbating the severity of the learning crisis in Sierra Leone.[24]

Sierra Leone, a country on the southwest coast of West Africa, had a gross domestic product (GDP) of $509.48 per capita, by that measure the average American is 137 times richer. 3.3 million children go to school in Sierra Leone – nearly 40% of the population, this makes teachers overworked and overwhelmed with excessive responsibilities, leaving them exhausted or unable to give enough attention to each task or student in a classroom of an average 42 students.[25]

This is where The Teacher AI comes to play. The chatbot runs on WhatsApp, as it performs better under poor internet connection than any other application, which needs downloading, or a website, which requires a lot of data and a better internet connection.

Another reason WhatsApp was chosen for this job is because of the familiarity of the teachers with the application; this reduced training time and effort. As Sierra Leone is a poor country, the likelihood of students owning smartphones is very low, but most teachers have one which is why creating an AI chatbot for teachers was the obvious choice.

The Teacher AI chatbot works through WhatsApp, where users send messages to a chatbot number. These messages go through Twilio (a cloud communications platform) to an Application Programming Interface (API), which tracks chat history and sends requests to OpenAI's GPT-3.5 Turbo for responses. The system message, based on a modified Helpful, Honest, and Harmless (HHH) prompt, reinforces guidelines and restrictions to prevent misuse. To stay within GPT-3.5 Turbo's 4096-token limit, older messages are removed as

needed. GPT's default responses may be more tailored to U.S. teachers than those in Sierra Leone, which is why an effort was made to ensure responses are culturally sensitive, pedagogically relevant, and aligned with local context. Additional safeguards are in place to protect children and prevent inappropriate content. The system was implemented in 122 schools and over 193 teachers participated. The findings showed that teachers used the system for lesson planning, clarifications, professional development and more, as shown in figure 5.[26]

Functionality	%	Example Query (Paraphrased)
Concept clarification	48%	What does "cracy" mean in "democracy"?
Lesson planning	21%	Prepare a lesson to teach word families in a phonics class.
Writing support	7%	Make a short story with these words: [list of words].
Teachers' professional development	6%	Write a research proposal on addressing food insecurity.
Classroom communication	5%	Discuss the importance of positive feedback to students.
Behavioral management	3%	How do you discipline students coming to school late?
Exam and assessment	3%	Suggest two math problems to prepare for WASSCE.
Subject matter problem-solving	3%	Calculate the length of a diagonal of a 5-by-7 rectangle.
Parent and community engagement	1%	How can you strengthen school-community relationships?
Greetings or gratitude to the chatbot	1%	OK, thank you.
Supervision of other teachers	<1%	How do you coach teachers as a school leader?
Asking AI chatbot to continue	<1%	Continue to receive part 2 of your answers.

Figure 5: How teachers benefit from The Teacher AI – Source: Cornel University

3. Synthesia in Bolton, England:

Bolton University is known for its focus on practical learning and its strong connections with local industries. It is recognized for offering a supportive environment, prioritizing student success and employability. The university also has a reputation for excellent teaching, small class sizes, and active community engagement, all of which help students gain hands-on experience alongside academic learning. One of the ways Bolton ensures high student engagement and practical learning is by creating engaging videos on challenging topics and providing training assistance.[27]

However, creating these videos presented a challenge due to the time-consuming nature of the process. It required significant manpower, from researching the topic to writing scripts, filming, editing, managing physical studio setups, and learning complex editing software. To

overcome these challenges, the university decided to partner with Synthesia, an already established AI-powered video creation company.[28]

Synthesia simplifies the video creation process by allowing users to input a script, choose an AI avatar and voice, and customize settings and animations, as shown in figure 6. The platform then automatically generates the video, significantly reducing manual effort and delivery time. Since adopting Synthesia, Bolton University has reported an 80% reduction in video creation time, leading to the production of 400 additional educational videos per year. This has expanded their extensive library, and students have expressed high satisfaction with the results.[29]

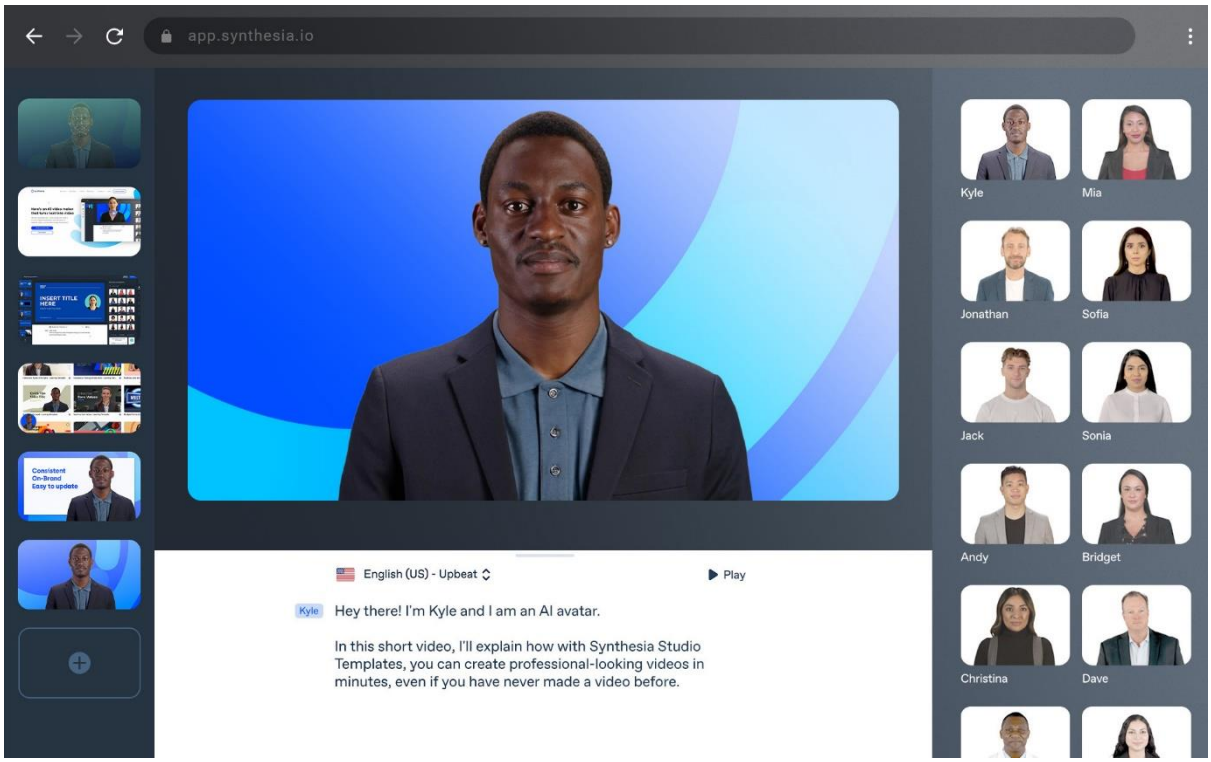


Figure 6: The interface of Synthesia – Source: FIRST MARK

Potential Risks of Implementing AI in Education

1. Overreliance on AI may dampen critical thinking, creativity, and emotional development in students.

2. AI algorithms have shown algorithmic biases, promoting gender and racial stereotypes, which could result in the mass spread of biased information.
3. The implementation of AI requires teacher training and development programs, which are currently lacking in the KRI.
4. There is unequal access to technological equipment, such as computers and smartphones, as well as reliable internet and electricity. This can increase the gap between students who can afford private schools and those who don't.
5. Limited resources and data in the local languages, along with the lack of digital copies of curriculum materials for copyright issues related to unauthorized reproduction (such as printing and selling books without the publisher's permission).
6. AI is still in its early stages and may sometimes provide incorrect or misleading information, known as "hallucinations" which presents a big problem especially for students, who may struggle to verify responses.

Future Prospects

The integration of AI in education can transform education and open doors for new opportunities to the new labor force that will shape the future of the region. To effectively adopt AI the following recommendations should be considered:

1. Support Teachers: There needs to be legal frameworks to support teachers. Provide them with the necessary training programs and monetary support they need to create room for innovation, such as integrating AI effectively into their teaching practices.
2. Foster Collaboration: Encourage collaboration between educational institutions, technological companies, policymakers, and researchers to create AI-driven technologies.

3. Cultivate Innovation: Create a culture that encourages the public to experiment with AI tools and integrate them into their daily lives and professional careers, while providing resources to make such endeavors easier.[30]

Conclusion

The KRI has a promising opportunity to use the power of AI to enhance digital literacy and enhance traditional education systems to create rapid economic growth. AI can expand access to education for everyone, including for those previously excluded. Especially by enhancing access to high-quality education. By learning from successful case studies and implementing key recommendations, the KRI can effectively integrate AI to strengthen its education system while addressing existing challenges.

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ABOUT

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CONTACT

CHANNEL8 BUILDING,

KURDSAT QTR., SULAYMANIYAH, IRAQ

+964-773-608-8885

INNOV8@CHANNEL8.MEDIA