ARTIFICIAL INTELLIGENCE REVOLUTIONIZING ONLINE EDUCATION

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Abstract

The recent COVID-19 pandemic forced universities to move to online education, many of which would not have considered online courses without that impetus. Subsequently there has been a surge in online courses. Online courses take a long time to prepare and frequently the delivery and execution is of low quality. One way to overcome both limitations is to use the powerful paradigm of Artificial Intelligence, especially Large Language Models, to develop and deliver online courses. In this paper, we introduce "AI Lecturer", an innovative solution powered by a Large Language Model that is designed to improve the quality and delivery of lessons in educational institutions. The paper discusses related work in online course delivery and locates our solution in this space. The AI Lecturer functionality is presented and includes AI-powered automated lesson preparation, interactive teaching through AI avatars, and personalized homework generation and evaluation. A survey was carried out to evaluate student satisfaction and learning using AI Lecturer. The survey results will be presented. Respondents expressed a high degree of satisfaction with the user interface and overall experience, found the lifelike avatars engaging, and indicated they would recommend the platform to others. Finally, we will discuss the advantages and disadvantages of our platform and the challenges students faced when using it.

Keywords: AI lecturer, online education, interactive teaching avatars, automated personalized homework.

1. Introduction

In recent years, the world of education has witnessed a profound transformation, driven by artificial intelligence (AI) and technological innovation. As technology continues to evolve, it is no longer confined to mere facilitation but now plays a central role in the pedagogical process. In this dynamic and ever-changing context, we introduce AI Lecturer, AIL, an innovative solution that leverages the power of AI for online learning (https://myai-edu.com/). Online education, once considered a niche alternative, has surged in popularity and relevance (Papadakis, 2023). Recent pandemics have changed the way we think, how knowledge is produced, and how education is perceived. This has led to the popularity of Massive Open Online Courses (MOOC) - based learning (Shah, 2021). Recent reports indicate that millions of new users have registered on popular MOOC platforms (Gomez et al., 2022), though many do not complete the courses.

An additional impact on online education is the revolution of AI and Large Language Models (LLM), (OpenAI, 2022). With the advent of AI and machine learning, online learning has not only become more accessible but is evolving into a personalized educational experience.

UNESCO (2021, p. 27) offers this advice to educational managers and policymakers: "…as AI functionalities improve, they will inevitably relieve teachers of increasing numbers of burdens. Accordingly, as the AI tools take over the knowledge transmission tasks, facilitating students' lower order thinking, teachers will play a reduced role. Theoretically, this will allow teachers to focus more on the design and facilitation of learning activities that require higher-order thinking, creativity, interpersonal collaboration, and social values – although, no doubt, AI developers are already working to automate these tasks too. Accordingly, to ensure that teachers continue their critical role in the education of young people policy makers must review strategically how AI might transform teachers' roles, and how teachers might prepare to work in AI-rich education environments."

Three features are deemed important for effective online education: motivation, engagement, and personalized learning. Chazan and Ball (1999) say that classroom interaction needs to be intellectually motivated in order to be productive for learning. It seems critical that teachers monitor and manage classroom disagreement in order to support and sustain intellectual ferment. Our solution offers an AI clone of the lecturer image, lip synchronization, and state-of-the-art text-to-speech technology. The avatar

conducts lectures and delivers content with an authenticity that captures the students' attention and elevates their engagement with the material. The AI clone serves as a catalyst for questions and discussions.

Senthamarai (2018) states that interactive teaching approaches should be designed to help students engage with the material and meet the objectives. Educators need to create, or select, the instructional activities to engage students. AIL allows the teacher to create online questions and activities to meet the learning objectives.

According to Makhambetova, Zhiyenbayeva, and Ergesheva (2021) personalized learning is a major factor in improving academic achievement and motivation in education. In our proposed AIL solution, personalisation takes centre stage by offering personalized homework assignment generation, personalized discussion with the student and a personalized approach to lesson delivery. Leveraging the capabilities of AI, the platform assesses each student's understanding through their interactions with the AI clone and tailors' homework assignments accordingly. This forward-thinking approach ensures that students receive tasks that align with their learning pace and specific needs, coupled with automatic grading (Figure 1.).

Figure 1. Automated grading system.
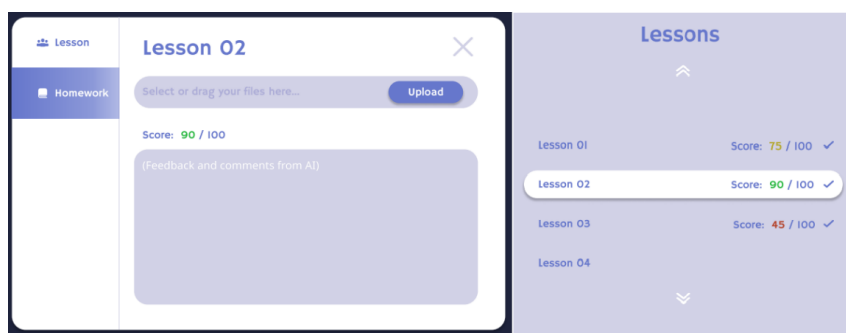
2. Related work

In this Section we will discuss latest developments in the field of online education and compare the most popular online learning platforms with our proposed solution.

Coursera (http://coursera.org) and edX (https://www.edx.org) are popular online education platforms that offer a wide range of courses from top universities and institutions. While they provide access to quality education, they rely on traditional video lectures and lack the personalized features of AIL.

Khan Academy (https://www.khanacademy.org/) is known for its adaptive learning platform, that adjusts content based on a student's progress. However, it lacks the real-time interactivity and AI-driven lesson delivery of AIL. Carnegie Learning (https://www.carnegielraning.com) is an AI-driven educational technology company that provides personalized math instruction. It uses AI to adapt lessons based on student performance. It is restrictive to math instruction only whereas AIL is comprehensive. IBM Watson Education (https://www.ibm.com) offers AI-powered tools for educators and institutions. It focuses on analytics, cognitive tutors, and chatbots for administrative tasks. It is an assist tool compared to AIL that has a defined process for creating and delivering online content. Zyrobotics (https://www.kidscodingapp.com/) is known for its use of AI-driven avatars to teach children with special needs. This demonstrates the potential of avatars in enhancing engagement, but it does not cover the breadth of subjects or advanced features found in AIL. Virtual Reality (VR) and Augmented Reality (AR) platforms like Google Expeditions (https://sites.google.com/tcsnc.org/tcs-g-expeditions/ google-expeditions-app) and Oculus for Education (https://unimersiv.com/review/deep-space-vr/) have been used for immersive learning experiences. They offer unique interactivity but require specialized hardware and are not as widely accessible as web-based platforms like AIL.

Knewton (https://www.knewton.com) is an adaptive learning platform that uses AI to personalize course materials. It offers personalized recommendations and assessments but lacks the real-time interactive features of AIL. DreamBox (https://www.dreambox.com/) is an adaptive math program for K-8 students. It provides personalized lessons but does not offer the comprehensive suite of features provided by AIL.

Turnitin (https://www.turnitin.com/) is widely used for plagiarism detection and feedback. It simplifies the grading process but does not provide lesson delivery. There are learning analytic tools like Blackboard (https://www.blackboard.com/group/136) and Canvas

(https://www.instructure.com/canvas) are learning management. systems for managing the learning process. Plugins can be included to aid lesson preparation and delivery. But there are no automatic features for generating lesson content from slides nor to deliver the content.

3. Component architecture

The component architecture is shown in Figure 2 and consists of:

A. AI-Powered Automated Lesson Preparation. AIL simplifies lesson preparation for educators, leveraging AI algorithms to generate textual notes and questions based on uploaded presentations.
B. Interactive Lesson Delivery. The platform employs AI avatars to deliver lessons, enhancing student engagement and learning.
C. Interactive Teaching Approach. Two-way communication between students and AI avatars fosters active participation and dynamic learning. This is achieved through a Chatbot based on the topic given in the lesson name.
D. Personalized Homework Assignment Generation. Assignments are based on individual student interactions, ensuring tailored learning experiences. They are created through variables that include the lesson topic and student questions and answers.
E. Efficient Homework Evaluation. Student submissions are graded automatically.

Figure 2. Component Architecture.
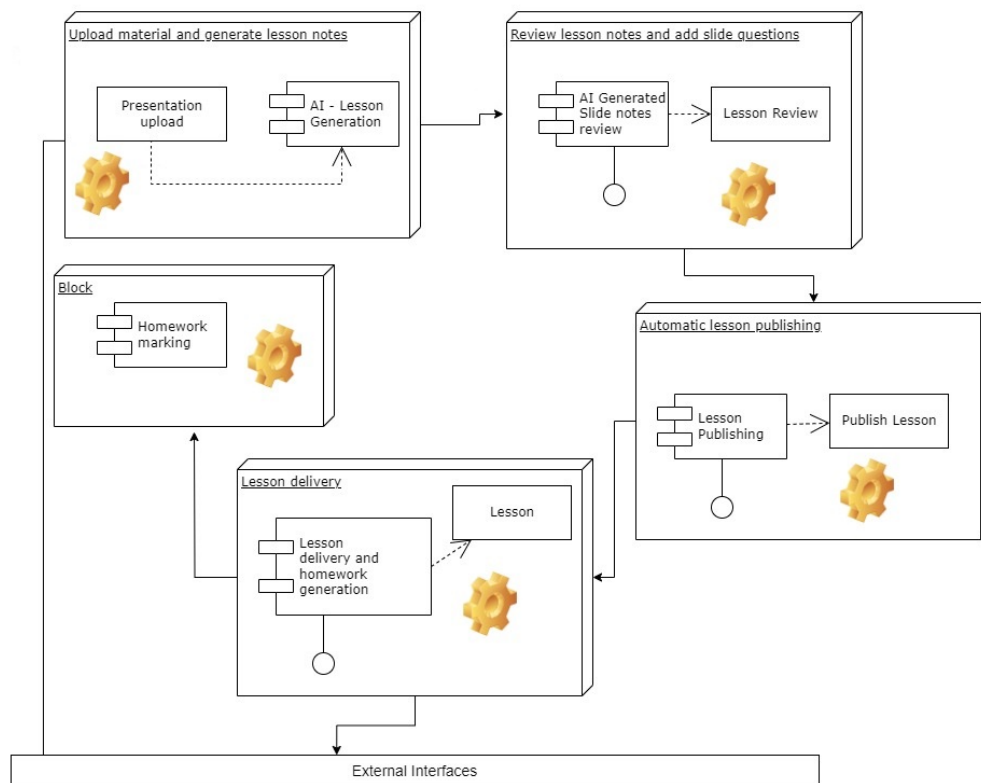
4. Advantages and disadvantages

AIL is a prototype. It has been tested on a group of students in the Faculty of AI and Robotics at Raffles University (RU). 20 students were surveyed to evaluate their learning through AIL. The Student Satisfaction and Learning Quality Questionnaire was designed following the methodology recommended by Vanderleeuw, Keim, and Moore (2023). It was divided into four sections. The first was to gain feedback on student engagement and satisfaction with AIL. In the second section students were asked to compare learning quality between AIL and the traditional face to face approach. The third section asked the students to describe their learning experience and challenges faced using the platform. The fourth section asked for feedback on how to improve the platform. The questions are:

Section 1: Platform Satisfaction and Engagement
1. On a scale of 1 to 5 (1 being strongly dissatisfied, 5 being extremely satisfied), how satisfied are you with the platform's user interface and overall experience?
2. How often do you engage in interactive activities (e.g., asking questions, participating in discussions) on the platform during lessons?
3. Do you find the lifelike avatars engaging and effective in delivering content? (Yes/No)
4. Rate the platform's responsiveness to your queries and interactions (1 - Very slow to 5 - Very fast).

Section 2: Learning Quality Comparison
5. How likely are you to recommend our platform to a fellow student? (1 - Not likely to 5 - Very likely)
6. Have you experienced other online learning platforms? (Yes/No)
7. If yes, please indicate which learning mode you find more engaging and conducive to your learning (Face-to-face / Online using our platform). [Face-to-face means online live face-to-face online learning.]
8. On a scale of 1 to 5, please rate the level of personalized attention and assistance you receive through our platform compared to face-to-face learning.
9. Do you believe our platform helps you retain and understand course material more effectively than traditional methods? (Yes/No)
10. How confident are you in your ability to apply the concepts learned through our platform to real-world situations? (1 - Not confident to 5 - Very confident)

Section 3: Learning Experience and Challenges
11. Describe a specific instance when the interactive features of the platform enhanced your understanding of a topic.
12. Have you faced any challenges while using the platform? If yes, please elaborate.
13. How has the availability of recorded lessons for later review impacted your learning experience?

Section 4: Additional Comments
14. What aspects of the platform do you find most beneficial for your learning experience?
15. Are there any areas of improvement you would suggest for the platform to enhance learning quality and engagement?
16. Any additional comments or suggestions for enhancing your learning journey?

The selective sampling method means statistical analysis does not apply, only descriptive statistics. The survey responses are summarized in Figure 3 for Sections 1 & 2 (Questions 1-10). For questions with a rating scale, the frequencies shown are the counts for 4 & 5 combined. For yes/no questions the frequencies shown are for Yes.

Figure 3. Student survey results.
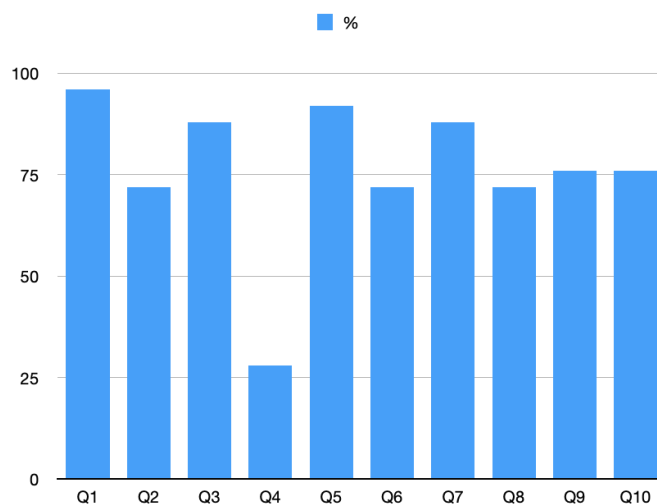
Responses above 50% are positive and below 50% are negative. As can be seen, all but one response is above 50%. The rating for responsiveness was low (28%). This is because there is bad internet connectivity in parts of Johor and limited capacity in some student homes. 96% of the students were satisfied with the platform and 88% liked the avatars. The students liked the question and answers through the Chatbot and being able to learn at their own pace. Their major challenge was slowness of

response due to poor internet connectivity, as noted above. For improvement the students recommended including the slide number and total number of slides. These results are indicative only, but they do show the potential of the platform to improve online learning.

4.1. Advantages

AIL provides a platform that automatically generates teaching content, an audio-visual file with avatars to deliver the content that is interactive and marking of student homework. This saves the lecturer time and effort. It is also good for new lecturers or those not comfortable speaking in front of a class. The AI generated avatar provides consistency in the speaking voice.

AIL architecture supports student motivation, engagement, and personalized learning, three features deemed essential for effective online learning.

4.2. Disadvantages

There are several limitations regarding content generation from the uploaded PowerPoint slides. First, no content will be generated if the slide solely contains a picture. There must be some key words on the slide for the AI generator to work from. Second, the amount and accuracy of the content depends on the subject matter. Topics where there are a wide variety of resources available on the internet will generate better content, e.g., a course on statistics. Esoteric subjects, such as the philosophy of E.A. Singer, Jr., may generate no, little, or wrong content. In these situations, you will have to write your own content. The image must be square when uploading your own image to create an avatar of yourself otherwise part of your head will be cut off. It is best not to smile. If you smile and show your teeth the avatar will show your teeth as it speaks, which is not realistic. You should have your lips closed for better authenticity. The avatars may not appear to be authentic or realistic for some users and they may see this as a disadvantage. This is a controversial topic. Some researchers argue that avatars should not be human-like, others that they should be. We have adopted the first position.

Lastly, the Chatbot and homework generation are generated by AI. The Chatbot replies and homework marking may not agree with what you have written during content generation.

5. Conclusion

This paper has presented an AI platform for online lesson generation and delivery. The AIL functionality was presented and includes AI-powered automated lesson preparation, interactive teaching through AI avatars, and personalized homework generation and evaluation. An informal student survey, using selective sampling, indicated the majority of students found the platform engaging and liked the avatars. The advantages and disadvantages of AIL were discussed.

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