Teaching physics using artificial intelligence

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Abstract. In the field of education, in addition to the evaluation of learning process, the examination of the effectiveness of teaching plays an important role. Teachers are often hopeless to see what prior knowledge and competencies the student is coming from and thus what the ideal developmental task is in the given lesson. In this research topic, our goal is to create a computer program that can learn what practice task a student should solve for the most optimal development based on his/her knowledge and competencies.

Introduction

The research topic discussed in the passage aims to develop a computer program that can identify the optimal practice task for a student based on their prior knowledge and competencies. One of the challenges faced by teachers is to determine what developmental task a student should work on during a given lesson. However, by leveraging machine learning and predictive analytical tools, it is possible to create a computer program that can learn and analyze data to identify the best practice task for each student.

It is widely recognized that the use of information and communication technology (ICT) has had a significant impact on education systems and learning processes. With the increasing availability of online tutorials and courses, there is a wealth of data available that can be used to classify and analyze student behavior. Machine learning techniques can be used to make course recommendations more effective by considering students' usage preferences and helping to match them with appropriate courses. [1]

In addition to course recommendations, machine learning methods can also be used to evaluate the effectiveness of teaching. Traditional teaching methods can be complemented by machine learning techniques to provide a more comprehensive assessment of student learning. These methods can help teachers to optimize the development and practice tasks for the student and evaluate the effectiveness of their teaching methods. [2]

Schematic of the algorithm

The essence of the planned algorithm is shown in Fig. 1. Before completing a given specific test, we assess students' general competencies (mathematics, reading literacy, science) as finding the optimal pathways for development is highly dependent on these abilities. Students then complete a subject related, specific test (mechanics in our study). Based on the result, it identifies the typical misconceptions and errors and then releases a version of the practice tasks to correct them. The system monitors the solution of practice tasks and provides feedback to the student. The student then repeats the same test. Based on the results, the machine analyzes the progress. The machine monitoring the input parameters (competencies), the specific test results, the solution of the practice tasks and the development data. Based on many fills, this results a huge data set. Artificial intelligence sees through the correlations and refines the practice process based on it, allowing students to develop personalized optimization. The cycle can, of course, be repeated.

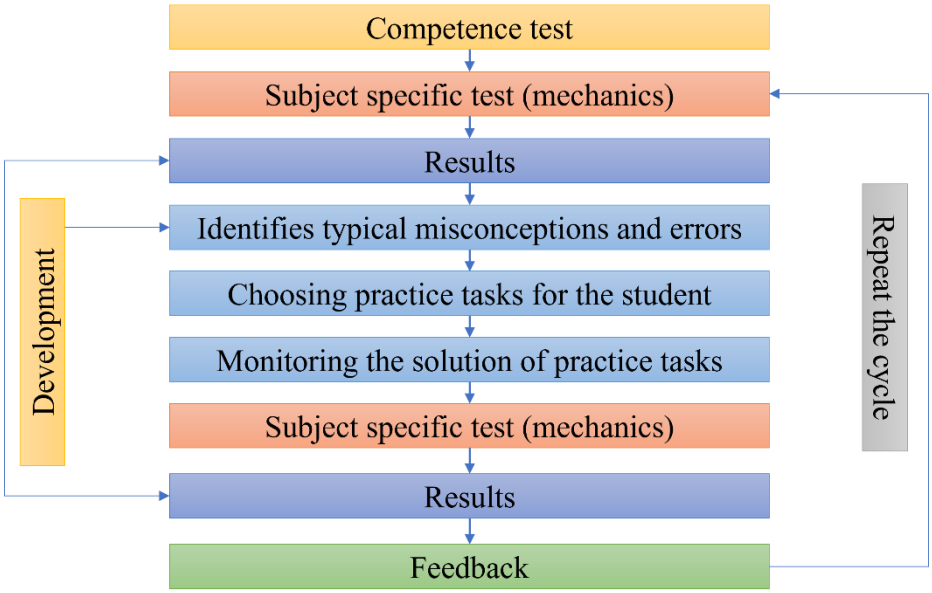

Fig. 1.The schematic of the algorithm

Educational experiment

The experimental group of the educational experiment will be high school students from the 9th to the 12th grade. Pilot tests will start in april, the large-sample experiment is planned for 2024. By collaborating with physics teachers, we can reach hundreds of students during the pilot test, which should provide us with enough data to identify the essential correlations. In my presentation I will describe in detail the background of the algorithm and the preliminary results.

References

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[2] Nilashi, M., Minaei-Bidgoli, B., Alghamdi, A., Alrizq, M., Alghamdi, O., Nayer, F. K., ... & Mohd, S. (2022). Knowledge discovery for course choice decision in Massive Open Online Courses using machine learning approaches. Expert Systems with Applications, 199, 117092.