



## Adapting Students' Learning Styles Using Artificial Intelligence in Learning Computer Science Concepts and Developing Educational Robots

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### Abstract

By integrating artificial intelligence, this paper presents a method designed to help students learn more efficiently, benefiting from personalized education in algorithms and educational robot programming, which has enhanced the potential of each student. Adapting to current learning needs as well as for the baccalaureate exam, artificial intelligence was used as a study support to provide educational information, detailed explanations, and guide students through the steps to obtain clearer, more learning-oriented answers.

**Keywords:** artificial intelligence, computer science concepts, educational robots, haptic devices, personalized active learning

**JEL Classification:** C63, C69, I21, I26, I29.

### 1. Introduction

To enhance the quality of the teaching and assessment process in fields such as computer science, information and communication technology (ICT), or educational robotics, it is essential **Romanian International Conference for Education and Research 16th edition, 12th-13th November 2025 at Iași, Romania.**



to use modern, technology-based methods. Especially in learning algorithms and programming robots, students require a large number of individual tasks, interactive exercises, and personalized assessment items that help develop their logical thinking and technical skills.

The manual creation and correction of these activities involve a significant workload for teachers, which becomes difficult to sustain in the context of an already busy schedule. A viable and efficient solution is the integration of artificial intelligence into the educational process (Karsenti, 2019). By using AI systems, teachers can be assisted in the automatic generation of exercises tailored to each student's level, in providing instant feedback, and in assessing performance in real time.

This approach is further supported by the automatic import of generated materials and tests into e-Learning platforms, where students can revisit learning and self-assessment sessions as often as needed. Thus, the educational process becomes more flexible, personalized, and efficient—for both students and teachers.

## 2. Literature Review

Although there are risks such as cheating, the educational benefits of AI are significant and justify the need for further research (Ayala-Pazmiño, 2023). The implementation of artificial intelligence in education is becoming increasingly important, driven by technological advancements and the rapid digitalization of educational systems. To support the effective integration of AI technologies and promote a better understanding of them, Owoc, Sawicka and Weichbroth (2021) tested a five-stage strategic implementation model in three higher education institutions, analyzing both the benefits and the challenges of using AI in education.

Vakhabova, Kosulin, and Zizaeva (2025) highlight the benefits of artificial intelligence in education, including personalized learning, task automation, and increased access to knowledge. At the same time, they emphasize key risks such as ethical concerns, digital inequality, and algorithmic bias. Their study explores how AI can contribute to transforming education in alignment with the Sustainable Development Goals, particularly SDG 4 (quality education) and SDG 10 (reduced inequalities). Through a systematic analysis, the research provides a valuable



contribution by examining the relationship between AI adoption in education and sustainable development.

Chen and Liu (2007) conducted a study on 165 fourth-grade Taiwanese students, analyzing the effects of a computer-assisted, personalized problem-solving program in mathematics. The results showed that students who used the personalized program performed significantly better and had a more positive attitude toward mathematics compared to those who used a non-personalized program. These differences were reflected in both post-test scores and students' perceptions of learning.

### **3. Methodology**

The working methodology used was personalized active learning with Artificial Intelligence (AI). This involved the direct engagement of students in the process of learning algorithms and programming educational robots, while providing them with continuous feedback and personalized resources.

The study was conducted over the course of two academic years and included 52 students (67.31% boys, 32.69% girls) specializing in mathematics and computer science.

The first year was considered the control group, while during the second year, AI was integrated and the group was considered the study group. Students were informed that they could compare their own answers with those generated by AI and analyze them; they were not required to wait for AI-generated solutions. They were encouraged to use AI for:

- explanations and step-by-step guidance;
- checking their own solutions;
- rewriting or optimizing their ideas with the help of AI.

Throughout the two years, the activities followed the mandatory national curriculum in subjects such as Computer Science, Information and Communication Technology (ICT), and robotics lessons available on the platform Resurse educaționale și activități didactice (Coșniță).

The computer science curriculum in the Romanian educational system includes topics such as algorithms and programming, cybersecurity, artificial intelligence, robotics, web development,



educational and utility software, networking, and information and communication technologies (ICT).

### **3.1. The aim of the research**

The study aims to analyze students' performance over the course of two consecutive academic years in the subjects of Computer Science, Information and Communication Technology (ICT), and Robotics, highlighting the impact of using personalized active learning based on Artificial Intelligence in the second year. The focus was on how the natural integration of artificial intelligence contributes to the development of computational thinking, reduces students' tendency to cheat, and leads to positive outcomes in the learning process.

### **3.2. The objectives of the research**

**O1.** Analyze the impact of using personalized active learning supported by AI on students' performance in the subjects of Computer Science, ICT, and Robotics.

**O2.** Study how the integration of artificial intelligence can support the development of computational thinking among students.

**O3.** Compare students' results from the two academic years, following the implementation of personalized active learning.

### **3.3. Implementation**

A Moodle platform with AI extensions (*Resurse educaționale și activități didactice*), an AI-based educational engine for adaptive learning (*NextLab.tech*), and the “Study Mode” function integrated into the *ChatGPT* interface, selected with the “Study and learn” option, were used. *ChatGPT* provides a personal educational assistant called “study mode.” This usage module can generate quiz questions, create exercise sheets, or training problems.

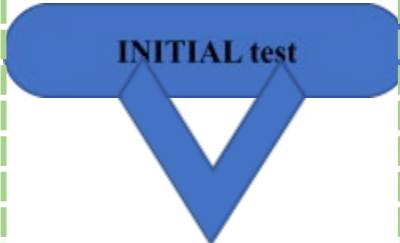



In a preliminary stage, the teacher:

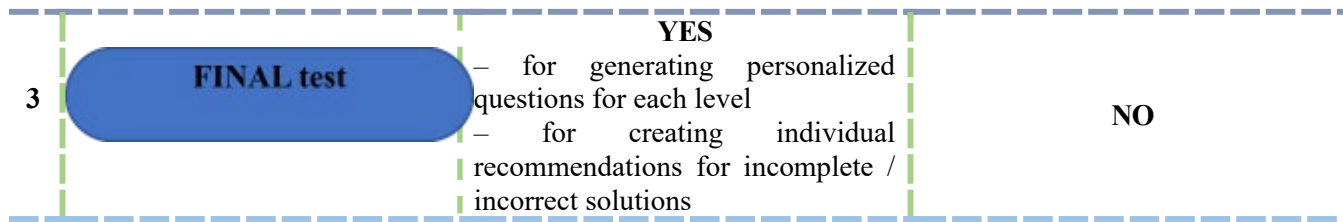
- created model problems that define a class of problems;

- built “problem classes” using artificial intelligence, which allowed for the automatic generation of different problems belonging to the same class and having the same level of difficulty.

In the first stage, the initial test was administered and completed by students on the *Resurse educaționale și activități didactice* platform, which is based on the Moodle learning management system and is used by both teachers and students for task delivery and assessment (Cosniță). During this stage, *ChatGPT* was used exclusively by the teacher for planning and support purposes, while students were required to solve the test independently, without access to the internet or artificial intelligence tools (OpenAI).

In the second stage, worksheets and training tests were used, with the objective of acquiring and consolidating knowledge through practical activities. The platforms *NextLab.tech* and *Resurse educaționale și activități didactice* were used by both the teacher and the students during the working and evaluation process (NextLab.tech; Cosniță), while the *ChatGPT* platform was employed by students as a support tool in carrying out personalized active learning activities (OpenAI).

STAGE	Using AI	
	Teacher	Students
1  <b>INITIAL test</b>	<b>YES</b> – for adapting the difficulty level – for generating problems within the same class	<b>NO</b>
2  <b>Practice Worksheets + Training tests</b>	<b>YES</b> – for adapting lesson content based on training test results – for suggesting additional exercises – for automating testing	<b>YES</b>  <b>Personalized learning</b> – for understanding task requirements – for step-by-step guidance – for suggestions on rephrasing answers   <b>Active problem-solving</b>



**Figure 1.** Design of the implementation

During the "personalized active learning" phase, students worked on problem classes using artificial intelligence, which enabled them to explain concepts step by step, receive immediate feedback, generate summaries or learning sheets, and rephrase complex information.

The automatic grading and correction system on the educational platform *Resurse educaționale și activități didactice* (Cosniță) allowed the teacher to monitor how long each student took to complete tasks, the number of attempts made, and whether the student submitted a correct or partial solution. The platform enables objective assessment, provides instant results, and eliminates the risk of subjectivity in grading.

In the third stage, the final test was administered on the *Resurse educaționale și activități didactice* platform, which was used by both the teacher and the students for test delivery and completion (Cosniță). To diversify the evaluation items, the teacher used *ChatGPT* as a tool for generating and adapting assessment content (OpenAI). To reduce the risk of cheating, students were allowed to use AI tools only during the "personalized active learning" phase and did not have access to artificial intelligence during testing on the *Resurse educaționale și activități didactice* platform (Cosniță).

## 4. Results and Discussions

The study lasted 2 years and involved 52 students from grades 11 and 12, 35 boys (67.31%) and 17 girls (32.69%) specializing in mathematics and computer science, with an intensive focus on computer science.



The method of “personalized active learning” was applied in the subjects of Computer Science, Information and Communication Technology (ICT), and Robotics, involving the use of AI and “problem classes.”

Competences		Computer Science	ICT	Robotics
<b>Control group (First Year)</b>	Means scores	8.895	8.894	7.897
	Stand.dev.	16.339	13.896	68.642
<b>Study group (Second Year)</b>	Means scores	9.076	9.007	9.089
	Stand.dev.	18.66	19.002	17.038
<b>Pearson coef. (R)</b>		<b>0.0971</b>	<b>0.0554</b>	<b>-0.0877</b>

**Table 1.** Pearson Coefficient Calculated by Subject

For Computer Science, the R coefficient (0.0971) indicates a very weak positive correlation, leading to a very weak and almost insignificant relationship. For ICT, the R coefficient (0.0554), although a positive correlation, is extremely weak and nearly nonexistent. For Robotics, the R coefficient (-0.0877) signals an almost nonexistent correlation, with a value very close to zero.

For each of the three subjects, the relationship between the use of personalized active learning supported by AI and the use without AI is very weak, almost insignificant, and the two implementations are not clearly linearly related.

## 5. Conclusions

Personalized active learning using AI provided real-time feedback, allowing students to adjust their solutions. The method adapted the learning process to the specific needs of each task, improving student performance over time. In programming educational robots, students developed skills such as autonomous decision-making.



During the pandemic, students strengthened their online learning habits. Online learning from 2020 to 2022 established the practice of seeking explanations, being guided, and obtaining information from Open Educational Resources (OER), turning first to a browser, then to an educational platform, and finally to a teacher.

The study proposes expanding e-Learning platforms by integrating AI-assisted learning. For students, this approach:

- accelerated their progress,
- optimized personalized learning,
- allowed them to explore complex ideas through step-by-step AI assistance,
- provided a way to receive quick feedback, develop their passions, and break out of daily

routines.

- They obtained solutions when they were NOT able to find their own,
- They provided a different approach to solving a problem,
- They managed to solve more complex problems, even unexpectedly difficult ones,
- They became more autonomous and gained greater self-confidence.

Artificial intelligence has the potential to improve education through personalized learning (Ayala-Pazmiño, 2023). Intelligent technologies have provided students with new perspectives.

For teachers:

- It reduced the time required to prepare teaching materials, as confirmed by Ayala-Pazmiño (2023);
- They were able to create multiple problems/exercises within the same “problem class”;
- They succeeded in engaging students to work more;
- They were able to train students more effectively in teamwork.

During the study, it was observed that NOT all students can use AI to complete practice sheets in an educational and responsible manner. There is a high risk of cheating. Students who are NOT interested in the subject are much more likely to copy and not actively learn through interaction with AI. These students do NOT consider AI as a mentor, but rather as a “solution generator.”



For students who showed interest in the subject studied, an improvement in performance at school competitions and academic olympiads was observed. The use of artificial intelligence tools enabled high-achieving students to refine their skills, test their own solutions more efficiently, and receive prompt feedback that either confirmed or refuted their approaches.

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