

INTEGRATING ARTIFICIAL INTELLIGENCE INTO THE TEACHING OF MOBILE APPLICATION PROGRAMMING

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Abstract: *This paper explores the application of Artificial Intelligence (AI) in the teaching and learning process in the course "Mobile Application Programming". The study aims to evaluate the potential of AI to enhance learning outcomes through personalised learning, automated assessment of student tasks, and the use of intelligent virtual assistants. The theoretical foundations of the course are outlined, and opportunities for integrating AI technologies into teaching mobile application development are discussed, including user interface design, event handling and asynchronous operations, local data storage, and REST API integration. Particular attention is paid to adaptive learning and automated feedback mechanisms that support knowledge acquisition and the development of practical skills. The paper presents an experimental study comparing traditional instruction with AI-supported learning and analyses the impact on student performance and motivation. The results indicate improved student engagement and higher completion rates of practical tasks when AI-supported learning methods are applied. Overall, the study highlights the role of AI in improving the quality and efficiency of higher education in the field of mobile application programming.*

Keywords: Artificial Intelligence, Mobile application programming, Education, Students, Adaptive Learning, Mobile Development.

1. INTRODUCTION

In recent years, artificial intelligence (AI) has become one of the most dynamically developing areas of information technology, with its application expanding into all spheres of society – from industry and medicine to education [3, 4, 7, 10]. University education in the field of computer science and engineering is also undergoing a transformation, driven by the need to integrate modern technologies into the learning process [1, 2, 6, 8].

The course "Mobile Application Programming" (MAP) occupies an important place in the training of future specialists in "Automation, Robotics and Computer Control Systems" at the Technical University of Gabrovo. It covers key topics such as mobile user interface development, activity and fragment lifecycle, event-driven programming, local

data storage (e.g., SharedPreferences, SQLite, Room), asynchronous operations, REST API integration, application security and optimisation. Acquiring this knowledge requires not only theoretical training but also significant practical experience to enable students to build and manage real mobile software solutions.

Traditional teaching methods often face challenges such as limited time for individual work with students, difficulties in providing timely feedback, and varying levels of prior knowledge within groups. In this context, AI offers new opportunities to optimise the learning process through:

- personalised learning;
- automated checking and assessment of tasks completed by students;
- using intelligent chatbots and virtual assistants to support independent learning.

Recent studies also explore the use of AI-based assistants in educational environments, focusing on student trust, continuous usage, and lesson planning efficiency [3, 5, 8]. These works highlight the pedagogical implications of AI and support the integration of intelligent feedback systems in technical and engineering education.

The aim of this article is to analyse the possibilities for integrating AI technologies into the teaching of the course "Mobile Application Programming", with emphasis on the approaches, benefits and challenges of their application.

2. DESCRIPTION OF THE SUBJECT AREA

2.1. The MAP course

The MAP course focuses on the design and development of applications for mobile platforms, primarily Android. The main topics include:

- mobile app architecture (activities, fragments, lifecycle);
- user interface development with XML and Material Design guidelines;
- event handling and asynchronous operations;
- local data storage (SharedPreferences, SQLite, Room);
- remote data exchange using REST APIs and JSON;
- integration with device sensors (camera, GPS, accelerometer);
- application packaging, testing, debugging and deployment.

The practical focus of the course requires students to develop real mobile application projects, combining theoretical knowledge with programming, interface design, and performance optimisation skills.

2.2. Artificial intelligence - main areas

AI includes methods and algorithms for automated problem solving requiring

cognitive abilities [5, 9]. The main areas are:

- Machine learning - models for data analysis and pattern detection;
- Natural Language Processing (NLP) - understanding and generating text and speech;
- Intelligent agents and chatbots - systems for interacting with users;
- Expert systems - systems for decision-making in specific areas;
- Computer vision and image recognition - analysis of images and video;
- Adaptive learning systems - personalisation of content according to the needs of learners.

Based on the characteristics of the course "Mobile Application Programming" and the main areas of AI discussed above, the following section presents specific approaches for applying AI in teaching the course.

3. APPLICATION OF ARTIFICIAL INTELLIGENCE IN MAP TRAINING

The integration of AI in MAP training opens a wide range of opportunities for improving the effectiveness, accessibility and personalisation of the learning process. Some of the key applications are discussed below:

3.1. Adaptive learning

AI can analyse individual student results and offer adaptive learning programmes. In this way:

- students with weaker results receive additional exercises and examples related to handling the activity/fragment lifecycle or simple UI layouts;
- advanced students are stimulated with more complex tasks such as API integration, background services and data persistence.

This increases motivation and optimises learning time.

3.2. Automated checking of student assignments

AI-based systems can automatically evaluate program code by analysing both the syntax and logic of Kotlin/Java code. Such tools:

- save teachers time;
- provide quick feedback to students;
- minimise subjectivity in assessment.

3.3. Intelligent chatbots and virtual assistants

Chatbots built into educational platforms support students by:

- answering frequently asked questions;
- explaining complex concepts such as lifecycle callbacks or asynchronous execution;
- helping with programming and debugging in Android Studio.

They act as a "virtual teacher" who is available at any time.

3.4. Recommendation systems and virtual laboratories

Like e-commerce platforms, AI can offer learning materials according to students' interests and progress. For example, a student who struggles with asynchronous operations or UI layout structuring can receive targeted explanations, examples and exercises on lifecycle management, event handling or interface design. AI can also be used to create interactive environments in which students experiment with mobile application development without the risk of causing errors on a physical device. This is achieved through Android emulators, sandbox environments and step-guided scenarios. This develops practical skills in a protected environment.

3.5. Predictive analysis and early intervention

AI models can identify students at risk of dropping out or underperforming by analysing their activity on electronic platforms, their pace of learning new concepts, and their frequency of

participation in exercises. This allows teachers to take timely measures to support them.

3.6. Automated feedback

Automated feedback allows students to receive timely and specific guidance on the quality of their Kotlin/Java code or interface design decisions. Instead of just reporting errors, the system analyses the structure, logic, lifecycle handling, and performance implications of the code and offers guidance for improvement. This supports self-assessment, accelerates the acquisition of good programming practices, and reduces dependence on direct consultation with the instructor.

4. RESEARCH METHODOLOGY

The aim of the study is to evaluate the effectiveness of applying AI technologies in a real learning environment and their impact on learning outcomes, motivation, and the development of practical skills in students. In this regard, two groups of learners are compared – those trained using a traditional model and those trained with integrated AI tools.

4.1. Concept

The study is conducted through an experimental approach with two groups of students:

- Control group (Group A): traditional teaching – lectures, exercises and laboratory classes without AI integration;
- Experimental group (Group B): training with integrated AI technologies – adaptive systems and chatbots to support mobile application development tasks.

4.2. Participants

- The study involved 20 second-year students enrolled in the course MAP.
- The students were already organised into two academic groups according

to the standard university timetable, and these existing groups were used as the control group (Group A) and the experimental group (Group B).

- The average age of the participants was 19–22. None of the students had prior experience with AI-based learning tools.
- The students had different levels of prior knowledge, which made it possible to assess the adaptive capabilities of the AI-supported learning approach.

4.3. Procedure

- Preliminary test: assessment of students' prior knowledge in the field of mobile application development, local data storage and programming;
- Training:
 - Group A receives traditional lectures and laboratory sessions;
 - Group B uses the AI-enhanced learning platform – adaptive exercises, automated Kotlin/Java code checking and a chatbot for assistance. The AI support was provided through the ChatGPT language model integrated as a feedback and code explanation tool during laboratory work.
- Final test and project: both groups develop a mobile application and are assessed using identical criteria;
- Student survey: gathering information on motivation, satisfaction and perception of innovation.

4.4. Analysis methods

- Qualitative analysis: evaluation of surveys and feedback from students.
- Quantitative analysis:
 - comparison of preliminary and final test results;
 - evaluation of the quality of mobile application projects and laboratory tasks;

- statistical tests to determine the significance of differences between groups.

4.5. Expected indicators

- Improvement in the academic performance and average grades of students in the experimental group;
- Faster acquisition of mobile development practical skills;
- Increased motivation and satisfaction with the learning process;
- Reduction in the time needed for checking assignments and providing feedback from the teacher.

4.6. Ethical aspects

- All participants participate voluntarily and with informed consent;
- Data is collected and processed anonymously;
- The use of AI does not affect the final assessment of students.

The described instructional conditions and sequence of activities allow the experiment to be replicated under equivalent teaching settings.

5. RESEARCH RESULTS

As a result of the study, in which AI technologies were integrated into the teaching of the MAP course, the following results were established:

5.1. Performance and achievements

- Final test and projects: Students in the experimental group (Group B) demonstrated higher performance in both theoretical tests and practical mobile application projects compared to the control group;
- Difference in average grades: Group B demonstrated a tendency toward higher performance in the final practical task compared to Group A. However, due to the small sample size, the result is indicative and

requires verification in further studies with a larger number of participants;

- In addition, qualitative feedback from students in Group B indicated increased confidence and satisfaction when working with AI-supported code guidance during laboratory activities.

5.2. Practical skills

- Students in the experimental group demonstrate better skills in:
 - programming and structuring mobile applications;
 - working with local data storage (e.g., SQLite/Room) and API-based client-server interactions;
 - using Android emulators and virtual laboratory environments to solve complex problems.
- AI-supported virtual labs allow students to test different scenarios and receive immediate feedback, which accelerates practical learning.

5.3. Motivation and satisfaction

- Survey results indicate that students in the experimental group reported higher motivation and confidence in their abilities;
- Chatbots and intelligent assistants provide quick help and reduce the stress associated with difficult mobile programming and debugging tasks.

5.4. Time efficiency

- The use of AI for automated assignment checking significantly reduces the time required for the teacher to assess and provide feedback.
- Students also save time through personalised instructions and adaptive recommendations that lead them directly to the resources they need.

5.5. Challenges and limitations

- Dependence on technology: Overuse of automated systems can reduce students critical thinking skills.
- Need for teacher training: To effectively integrate AI solutions, teachers need to familiarise themselves with the platforms and tools.
- Technical requirements: High-quality Android emulator environments require sufficient computer resources and a stable internet connection.

5.6. Interpretation of the obtained results

- The results confirm that AI can be an effective tool for improving the teaching process in MAP. Personalised learning, automated feedback and emulator-based virtual laboratories create conditions for better knowledge acquisition and practical skills development.
- However, AI should be seen as a supporting tool rather than a substitute for the teacher. Combining traditional methods with innovative AI solutions offers an optimal balance between autonomous learning, practical training and mentoring.

6. CONCLUSION

This study shows that the integration of AI into the teaching of the MAP course can improve the quality of the learning process. The results of the experiment confirm that the use of adaptive systems, emulator-based virtual laboratories, and interactive chatbots leads to:

- higher academic results and the acquisition of practical mobile development skills;
- accelerated knowledge acquisition and effective feedback;

- increased student motivation and satisfaction;
- a reduction in the workload of teachers through automated assignment checking.

Despite the positive results, the implementation of AI should be carried out as a supporting tool to traditional teaching, not as a replacement for it. It is important that teachers are trained to work with the platforms and combine innovative technologies with mentoring support and supervision of the learning process.

These findings highlight the potential of AI as a pedagogical enhancement rather than a technological substitute for the instructor. For future research, it is recommended to:

- to develop more complex emulator-driven virtual laboratories and mobile application simulations;
- to examine the long-term effects of AI use on students' skills and professional preparation;
- to integrate AI tools into other courses related to mobile technologies and software engineering.

The conclusions of this study emphasise that AI is an effective instrument for modernising the educational process and can support both students and teachers in achieving higher learning outcomes and improved quality of education.

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