

APPLYING INTERNATIONAL EXPERIENCES IN TEACHING PROGRAMMING TO HIGHER EDUCATION SPECIALIST STUDENTS: CHALLENGES AND SOLUTIONS

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Abstract: This article is dedicated to exploring the challenges and solutions of applying international experiences in teaching programming to higher education students specializing in this field. The article analyzes advanced educational models from countries such as the United States, the European Union, South Korea, and India (e.g., project-based learning, dual education systems, intensive courses, and online platforms). It examines the current state of programming education in Uzbekistan, highlighting issues such as insufficient infrastructure, low teacher qualifications, and outdated curricula. The obstacles to adapting international experiences to local conditions—financial constraints, language barriers, and cultural differences—are discussed. Practical solutions are proposed to address these challenges, including modernizing infrastructure, enhancing teacher qualifications, updating curricula, and expanding international cooperation. The article identifies promising directions for improving Uzbekistan's higher education system and preparing competitive IT specialists for the global labor market. With a total length of 4,000 words, the article is based on a scientific-methodological approach.

Keywords: Higher education, Programming, International experience, Curricula, Infrastructure, Teacher qualifications, Practical skills, Project-Based Learning (PBL), Dual Education System, Coding Bootcamp (Intensive programming courses), MOOC (Massive Open Online Courses), IT specialists, Digital economy, International cooperation, Educational quality

Introduction

In the modern world, programming has become a cornerstone of higher education, driven by the rapid development of information technologies (IT) and the digital economy, which increases the demand for highly skilled IT specialists. To prepare professionals capable of competing in the global labor market, adopting advanced approaches and international experiences in teaching programming is essential [3]. In the Republic of Uzbekistan, extensive reforms are underway to modernize the higher education system. Presidential Decree No. PF-5712 of April 29, 2019, "On Approving the Concept for the Development of the Public Education System of the Republic of Uzbekistan until 2030" [1], and Resolution No. PQ-4851 of October 6, 2020, "On Measures to Further Develop the Higher Education System" [2], aim to introduce international standards to enhance educational quality. However, challenges such as inadequate infrastructure, low teacher qualifications, outdated curricula, and students' lack of practical skills hinder the teaching of programming in Uzbekistan.

The purpose of this article is to analyze the advantages, challenges, and solutions of applying international experiences in teaching programming to higher education specialist students, while developing practical recommendations tailored to Uzbekistan's context. Advanced educational models from the United States, the European Union, South Korea, and India—such as Project-Based Learning (PBL), the dual education system, intensive courses, and Massive Open Online Courses (MOOCs)—were selected as the subjects of this study [3, 4, 5, 6]. These models have proven effective in equipping students with both theoretical knowledge and

practical skills, enhancing their global competitiveness [7]. However, the necessity of adapting these models to Uzbekistan's local conditions forms the core hypothesis of this research.

Methods

This study employed a comparative analysis method as its primary approach. To examine international experiences, educational models for teaching programming were analyzed, including those from the United States (MIT and Stanford universities) [3], Germany (dual education system) [4], South Korea ("Smart Education" and Coding Bootcamps) [5], and India (MOOC platforms) [6, 7]. Data on the structure, effectiveness, and implementation of these models were sourced from official websites and scholarly publications [3, 4, 5, 6, 7].

To assess the current state of programming education in Uzbekistan, the curricula, infrastructure, and teacher qualifications at the Tashkent University of Information Technologies (TUIT) and other technical institutions were reviewed [2]. Government documents, particularly presidential decrees and resolutions [1, 2], were used to identify the goals and limitations of the local education system. The feasibility of adapting international models to Uzbekistan's conditions was evaluated, and practical recommendations were developed using a synthesis method. All data were drawn from publicly available sources, with their relevance verified as of March 2025.

Results

The study revealed that international experiences in teaching programming are highly effective. In the United States, "Project-Based Learning" (PBL) encourages students to develop creative thinking through real-world projects [3]. Germany's dual education system integrates theoretical learning with practical training in IT companies, preparing students for the labor market [4]. South Korea's Coding Bootcamps enable rapid mastery of programming languages within 3-6 months [5], while India's MOOC platforms provide affordable and accessible education to millions [6, 7].

Analysis of the current state of programming education in Uzbekistan showed that curricula are predominantly theory-focused, with insufficient modern laboratories and software [2]. Teachers often lack proficiency in contemporary programming languages and technologies, and students exhibit a shortage of practical skills [1]. Infrastructure challenges, including slow internet and outdated computers, further complicate the educational process [2].

Key challenges in applying international experiences in Uzbekistan were identified:

1. Inadequate Infrastructure: Modern facilities like those in the US and South Korea are unavailable in most Uzbek institutions [3, 5].
2. Low Teacher Qualifications: Teachers do not meet international standards required for models like the dual system or bootcamps [4, 5].
3. Financial Constraints: Implementing initiatives such as SAP partnerships or MOOC platforms requires significant funding [4, 6], which exceeds Uzbekistan's education budget [2].
4. Language Barriers: Most international resources are in English, while English proficiency remains low in Uzbekistan, limiting MOOC usage [6].
5. Cultural Differences: India's self-learning model does not align with Uzbek students' reliance on teacher guidance [7].

Proposed solutions include:

- Modernizing infrastructure, drawing on South Korea's "Smart Education" initiative [5];
- Offering short-term Coding Bootcamps for teachers [5] and overseas training programs in collaboration with US and European universities [3, 4];

- Integrating PBL and dual education elements into curricula [3, 4];
- Localizing MOOC courses into Uzbek, inspired by India's approach [6, 7];
- Expanding international partnerships with Germany and South Korea [4, 5];
- Enhancing student motivation by creating high-paying IT jobs and attracting global companies.

Discussion

International experiences offer significant opportunities for Uzbekistan, but their full implementation requires adaptation to local conditions. PBL and the dual education system enhance practical skills [3, 4], yet their success depends on modern facilities and qualified instructors. Coding Bootcamps could yield quick results [5], but financial resources and teacher readiness remain critical factors. MOOCs provide cost-effective, scalable education [6, 7], though language barriers and internet infrastructure limit their effectiveness in Uzbekistan.

Addressing infrastructure and qualification challenges necessitates public-private partnerships. South Korea's "Smart Education" model [5] could be adapted locally, though it demands substantial investment. Teacher training through international collaboration (e.g., with the US and Germany) [3, 4] and local courses is vital. To motivate students, increasing IT job opportunities and engaging global companies are essential steps.

The proposed solutions could position Uzbekistan as a regional IT leader. For instance, establishing "Programming Centers" at TUIT [2], collaborating with "IT Park," and hosting international hackathons would boost students' global competitiveness. These measures not only improve educational quality but also contribute to economic growth [1].

References:

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