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THE ROLE OF ENGLISH IN PROGRAMMING EDUCATION: BARRIERS AND SOLUTIONS

English is widely considered the dominant language in global software engineering. Programming keywords, documentation, and platforms such as Stack Overflow and GitHub are predominantly in English. According to Russell et al., only 5% of the world's population are native English speakers, while approximately 15% use it as a second language [1]. This indicates that most developers must engage with English-language materials, making English proficiency essential for those aiming to participate in international teams or global open-source projects. The study also highlights that educational support for students with low levels of English proficiency remains under-researched. The dominance of English creates a systemic barrier for non-native English-speaking (NNES) students, who must simultaneously acquire programming concepts and the language used to express them [1].

This barrier is particularly relevant in countries such as Ukraine, where programming instruction is primarily conducted in Ukrainian. According to Guo, NNES students encounter difficulties when reading technical documentation, interpreting error messages, and interacting with English-based platforms, which may also reduce their confidence [2]. In Ukraine, these challenges become especially evident when students engage with materials beyond classroom instruction, as documentation, error messages, and key resources are available in English. Consequently, students with lower levels of English proficiency often struggle to solve problems independently, whereas those with higher proficiency can access a wider range of materials, potentially widening the learning gap. Research further suggests that a combination of English and the native language reduces cognitive load and improves comprehension, compared to exclusively English-language resources [1, 2].

Based on these findings, several recommendations can be proposed for teaching programming to Ukrainian students. First, while instruction may remain in Ukrainian, students should be gradually introduced to English-language technical documentation and error messages. Second, bilingual approaches that combine Ukrainian and English at the introductory stages can reduce cognitive load and increase learner confidence [3]. Third, integrating English for Specific Purposes (ESP) into software engineering curricula can support the development of technical communication skills necessary for global collaboration. Finally, AI-based tools, such as large language model (LLM) tutors, can provide on-demand explanations in a learner's preferred language, thereby facilitating comprehension and independent learning [4].

In conclusion, English plays a central role in programming education and professional communication. For Ukrainian software engineering students, the primary challenge lies in accessing global resources rather than in classroom interaction. Existing research suggests that bilingual instruction does not negatively affect academic outcomes, while improving learner comfort and engagement. By combining native-language support with structured exposure to English-language materials, ESP

integration, and AI-assisted learning tools, educators can better prepare students for participation in the global IT environment.

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