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Principles of bilingual instruction in mathematics for engineering students

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The subject of this research is the educational process of training engineers at a technical university within a bilingual framework, where professional disciplines are taught in a foreign language (English). The study focuses on both general didactic and specific principles of bilingual instruction in higher mathematics (disciplines of the mathematical cycle). Among the general didactic principles of the modern learner-centered philosophy of education that are relevant to bilingual mathematics instruction, the following are highlighted: the activity-based nature of learning, active interaction among all participants in the educational process, the problem-oriented character of instruction, learner-centered approaches, productivity of learning activities, professional orientation of education, multiculturalism, and humanistic development within the context of cultural dialogue. Taking into account the specifics of teaching mathematics bilingually at a technical university, a set of particular principles is identified: orientation toward achieving the goal of mastering mathematics (as a non-linguistic discipline); the use of both native and foreign languages as

tools of learning; the unity of thinking and speech activity in a foreign language; reliance on both native and foreign languages; rational limitation of communicative sufficiency; interdisciplinary connections and interdependence of different components within the system of engineering training; optimization of the learning process; gradual qualitative complication of educational content; reliance on prior school-level mathematical knowledge; and the development of motivation to acquire the ability and readiness to use a foreign language for professional purposes. The proposed principles of bilingual mathematics instruction at a technical university outline ways of applying the patterns observed in bilingual teaching and learning in accordance with the overarching strategic objective – namely, the development of bilingual subject competence in mathematics among future engineers.

Keywords: foreign language education, bilingual education, model of bilingual teaching/learning, didactic principles, subject-oriented didactic models.

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Teaching Homogenization Theory to Students: A Course and Laboratory Approach

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This paper presents a combined course and laboratory framework for teaching homogenization theory to undergraduate and graduate students. Homogenization is a branch of applied mathematics that studies the effective behavior of heterogeneous materials with rapidly oscillating properties. While the theory is abstract and often considered difficult for students, it can be introduced in an accessible manner through the special case of layered media. We propose a pedagogical strategy integrating rigorous lectures (definitions, lemmas, theorems, proofs) with laboratory activities (worked examples, numerical simulations, and student projects). The case study shows how abstract mathematical concepts can be transformed into a hands-on learning experience.