

THEORY OF TEACHING OF MATHEMATICS

Mathematical preparation of future undergraduate students

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study form: full time

Annotation: Analysis of mathematical preparation of secondary school pupils for university level mathematics with the aim to align the expectation of university lecturers with the possibilities of mathematical education at secondary schools. Development of proposals for the improvement of the status quo.

Inquiry-based approaches to teaching functions

supervisor: doc. RNDr. Stanislav Lukáč, PhD. (stanislav.lukac@upjs.sk)

study form: full time

Annotation: Nowadays, we can observe efforts to apply inquiry approaches to mathematics and science education. Elementary functions belong to the basic topics of school mathematics. Misunderstanding of concepts and relationships associated with functions and their properties leads to various students' mistakes and misconceptions. Inquiry approaches to teaching have the potential for inductive way of building knowledge and understanding of educational content. The research aims involve: analysis of the possibilities to implement inquiry approaches to teaching functions in high school; development of teaching and learning materials based on the application of inquiry approaches to teaching functions; examining innovative teaching and learning materials in mathematics teaching and evaluation of the effect of the designed approaches on the development of students' inquiry abilities.

Development of metacognitive abilities of pupils in solving problems

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study form: full time/external

Annotation: The basis for the development of pupils' metacognitive abilities is the analysis of mathematical problems according to different levels of cognitive difficulty in their solution. From the point of view of the teacher's management role in developing the metacognitive ability of pupils, it is important except for use tools of formative assesment to create „pre-problem“ – to reformulate, modify the problem to the simpler. which leads the pupils to solve the original problem and the „post-problem“ – to reformulate, respectively, create a new problem that builds on the original problem and extends the student's knowledge. Qualitatively oriented reseach will focus on the analysis of selection, creation, and awareness of problem-solving processes.

Diagnosis and development of computational thinking through solving of mathematical problems in programming environments

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study form: full time

Annotation: Problem solving is one of the key competencies of the 21st century (ATC21S, UNESCO, OECD, P21, EC). According to Cuny, Snyder and Wing (2010) under computational thinking can be understood as thought processes involved in formulating of problems and their solutions so that the solutions are represented in a form that can be effectively carried out by an information processing agent. Moreover, Wing (2011) adds also

that the solution can be carried out by a human or a machine, or more generally, by the combination of humans and machines.

The research problems of the dissertation thesis are: 1. Diagnostics of pupils' computational thinking. 2. Methods of developing pupils' computational thinking by solving mathematical problems in programming environments. Recommended methodological framework of the research is Design-based research with two outcomes: a diagnostic tool to measure computational thinking skills and a teaching methodology for solving of selected mathematical problems in programming environments.