

## **Theory of Teaching Mathematics**

### **Beliefs of mathematics teachers about mathematics and mathematics teaching in the context of functional thinking development.**

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study form: full time

**Annotation:** Educational researches are concerned about the knowledge of „a good teacher“ since the 80s. The models developed within this research have in common two dimensions. On one hand, the teacher should be safe in content knowledge and, on the other hand, a good teacher has high-quality pedagogical content knowledge. The new model includes the third dimension, which are teachers' beliefs about mathematics and its teaching/learning. Beliefs, as the cognitive dimension of an attitude, are among factors influencing the decisions of the person. In the context of mathematics education it means, the way in which a teacher thinks about mathematics and its teaching/learning has a kind of impact on how he/she teaches mathematics. Therefore, it is reasonable to inquire about mathematics teachers' beliefs. Particularly it means the following: Firstly, to find appropriate ways to „measure“ teachers' beliefs. Secondly, to measure the beliefs and subsequently to find ways how to influence them. The topic will be arranged in the context of the teaching of functions and functional thinking development.

### **Pedagogical content knowledge of mathematics teachers in the context of functional thinking development.**

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**Annotation:** Research aimed at exploration of knowledge of necessary skills of a good mathematics teacher shows that the teacher should have a good level of mathematical knowledge and, simultaneously, his/her pedagogical content knowledge (PCK) should be also of a high standard. PCK of mathematics teacher represents the only part of knowledge set for teaching and needs to be complemented by mathematical knowledge. Operating together, they inform and guide the decisions and actions the teacher must take in the course of their teaching. PCK consist of three subdomains. The first concerns the ways students interact with content, their expectations when faced with a particular content area, their difficulties and errors, and learning theories. The second subdomain of PCK comprise knowledge of strategies, techniques, tasks and examples; resources; and theories of teaching. The last subdomain includes expected learning outcomes according to educational and cognitive level of students, knowledge of curriculum and standards of mathematics. The dissertation thesis focuses on the development of a tool for measuring some components of PCK in the context of the development of functional thinking. The function concept is a central, but difficult, topic in the school mathematics curricula. Functions have different representations, and to make students perceive these as representations of the same mathematical concept is a pedagogical challenge.

### **Development of metacognitive abilities of pupils in solving problems.**

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**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 research will focus on the analysis of selection, creation, and awareness of problem-solving processes.

### **Inquiry-based approaches to teaching functions.**

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**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: 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 skills.

Literature: 1. Banchi, H., Bell, R.: The many levels of inquiry. In *Science and Children*, č. 46, 2008.

2. Carlson, M., O., Humphrey, G., E., Reinhardt, K., S.: *Weaving Science Inquiry and Continuous Assessment, Using Formative Assessment to Improve Learning*, 2003.

3. Held, E. A kol.: *Výskumne ladená koncepcia prírodovedného vzdelávania*. Pedagogická fakulta Trnavskej univerzity v Trnave, 2011.

4. Marshall, J., C.: *Succeeding with inquiry in science and math classrooms*. NSTApress, USA, 2008. 5. Tobey, Ch., R., Arline, C, B.: *Uncovering Student Thinking about Mathematics in the Common Core*. Corwin a Sage Company, 2014.

### **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.

Literature: 1. Martin Gould, Edward Hurst: *Bridging the Gap to University Mathematics*, Springer-Verlag 2009. ISBN: 978-1-84800-289-0

2. Ľubica Havírová: *Mathematical preparation of incoming university student*, Proceedings from the XVth Slovak–Czech–Polish Mathematical School in Spišské Podhradie, Slovakia, 2008, 113-118.

3. Alan Sultan, Alice F. Artzt: *The mathematics that every secondary school math teacher needs to know*, 2011 Routledge, Taylor & Francis. ISBN 0-203- 85753-4