

## Mathematics and Reflection

### Introduction

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The notion of reflection is a broad one, which can be approached from various directions. The intention of this volume is to consider reflection from a (socio-)philosophical and education theoretical point of view and to offer insight into various approaches. Thus, at the centre of attention in this issue are orientations of reflection which concentrate on the discussion of mathematics and its role for, meaning to and effects on each individual, on the learning community, on societal collectives and on the world in the narrow or broader sense. The reference points are mathematics itself, one's own relationship to mathematics and/or the effects of mathematics on systems, on the world.

In the sense of being an opening for this focus, a glimpse above and beyond, in place of different approaches, a metacognitive view of reflection and mathematics will be introduced as an additional aspect, in which the learners reflect on their own position in the learning process and thus make mathematics an object of their own thinking.

At the centre of attention of the quite fundamental article, *Materialization and Organization: Towards a Cultural Anthropology of Mathematics* by Roland Fischer, is the formulation of theses on the social relevance of mathematics. In R. Fischer's article it is not about the meaning of mathematics for someone actively dealing with mathematics, but about the meaning of "for somebody who is affected passively by mathematics, its applications, its power of regulation and order" (Fischer, p. 316, in this issue). Initially R. Fischer discusses the contribution of mathematics to "implicit culture, that means to our norms, value systems, patterns of organization, especially to civilization and regulation of modern societies" (p. 316, in this issue), which can also be unconscious, but are in any case presumptions in our daily lives. Building on that he turns his attention to the role and meaning of mathematics in the "explicit culture, which is processed in the consciousness of people, about which we speak, negotiate and

make decisions according to important/unimportant" (p. 316, in this issue). In this discussion R. Fischer always has a view to the meaning of mathematics for individuals, yet particularly to its relevance for the collectives, for social systems, for whole societies.

In his article *Reflections as a Challenge*, Ole Skovsmose shows general characteristics/aspects of reflection (necessity of reflection, functionality of non-reflection, specificity, collectivity, intentionality, diversity, fragility and uncertainty of reflection) and elaborates them. In it he focuses on mathematics-based actions and practices and an ethical dimension of reflection connected with such actions. By mathematics-based actions Skovsmose does not mean mathematical actions in the narrow sense of the word, but rather "all those practises that include mathematics as a constituting part. It could be: technological innovation; forms of production; automation; management and decision making; financial transactions; risk estimation; cost-benefit analysis, etc." (p. 323, in this issue).

Franz Picher describes an instructional operationalisation and elaboration of R. Fischer's reflection on the meaning of mathematics for individual and collective decisions in his article *Social Reflection in Mathematics Classes: Cooperation or Denial*. In his classes the meaning that is given or that can be given to mathematics with reference to social behaviour is analysed, reflected upon, discussed and assessed using extra-mathematical contexts. Franz Picher categorises the evaluation results in the form of a "reflection pyramid".

In her article, *Reflected Acting in Mathematical Learning Processes*, Katja Lengnink focuses on the reflection of one's own mathematical acting, whereby her mathematical acting "is seen as acting to reach goals within the field of mathematical knowledge" (p. 341, in this issue). The aim is, by using appropriate materials and designing learning environments in a suitable manner, actions will support reflection processes, making the rationale of mathematical approaches and the creation of mathematical concepts (more) conscious to the learner, thus promoting the development of mathematical literacy. These considerations are made particularly evident in a learning environment referring to number representation and extension of number domains.

The article, *Reflection and Metacognition in Mathematics Education – Tools for the Improvement of Teaching Quality* by Christa Kaune approaches the notion of reflection from the direction of metacognition. Ch. Kaune sees reflection as one of several metacognitive activities that have different nuances. In the course of her discussion she particularly focuses on the interaction between reflection and metacognition and on criteria for differentiating reflection from other metacognitive activities. The basis for her analyses and statements is a categorising system developed to classify metacognitive activities. It views reflection as one of these categories. Ch. Kaune's considerations are illustrated by examples of different mathematical and conceptual levels taken from math classes of high schools.

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