

THE DEVELOPMENT OF EPISTEMOLOGICAL BELIEFS IN THE COURSE OF MATHEMATICAL STUDIES

Anna Schreck & Benjamin Rott
University of Cologne

In modern societies, epistemological beliefs—that is psychologically held individual, supposedly domain-specific, understandings or propositions about knowledge and knowing (Hofer & Pintrich, 1997)—play an important role. For us, the impact of educational processes (with a focus on mathematics) at universities on the development and shaping of individual epistemological beliefs is of particular research interest. Generally, in psychological research, this development is described as starting with fixed absolutistic beliefs (such as “mathematical knowledge is certain”), reaching flexible, cross-linked, evaluative beliefs. However, findings of Rott and Leuders (2015, 2017) suggest that at least in mathematics the common classification of beliefs like “mathematical knowledge is certain” as naïve and “uncertain” as sophisticated is not applicable without analysing the arguments that back these belief positions.

The project at hand examines the development of university students’ belief positions and argumentations regarding the dimensions “certainty of knowledge” and “justification of knowledge” in the course of their mathematical studies. 1875 students were surveyed in October 2017, October 2018, and October 2019 at the University of Cologne in a longitudinal study. Considering the methodical findings and procedure of Rott and Leuders (2015, 2017), 586 students in 2017 (median semester 1), 433 students in 2018 (median semester 3) and 856 students in 2019 (median semester 4) of diverse mathematical university courses responded with written arguments (15-20 minutes per belief dimension) to answer open questionnaire items about epistemological beliefs during mathematical lectures.

The results show positional shifts from “mathematical knowledge is uncertain” and “inductively justified” towards “mathematical knowledge is certain” and “deductively justified”. This is surprising as the latter belief positions are linked to naïve beliefs in the literature. Especially students from mathematically challenging study programmes shift towards the afore-mentioned positions. The results also show that belief argumentation (i.e. reasoning supporting the positions) significantly increases during the course of the study, from ca. 5 % in 2017 to ca. 13% of the respondents who argue sophisticatedly in 2019. Looking at both results jointly raises questions concerning the widespread conceptualization of epistemological beliefs in psychological research, which is mostly tied to belief position (see above). The shift in positions and belief argumentation can probably be traced back to the common formal structure of university lectures, seminars and tutorials in mathematics. The actual reasons and liable education processes for belief shaping should be studied in greater detail in the future.

References

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