

FORMATS FOR PRE-STRUCTURED LEARNING OF HEURISTIC STRATEGIES IN MATHEMATICAL PROBLEM SOLVING - THE CASE OF HEURISTIC WORKED-OUT EXAMPLES

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This theoretical paper presents deductive conceptual work on the question: *Which theoretical potential of design principles and elements can be identified to foster the learning of heuristic strategies via the special format of heuristic worked-out examples (HWEs)?*, as part of the more general issue of possible formats for pre-structured learning of heuristic strategies in mathematical problem solving.

Referring to general action-based learning theories (Aebli, 1994, Galperin, 1969), and research on mathematical problem solving (e.g. Schoenfeld, 1985), we argue that having a heuristic strategy at one's disposal emerges from an individual's concrete problem solving actions – that is, *actions* in certain *situations* within concrete problem solving processes to reach certain *targets* – mainly by two complementing processes: internalising and classifying, catalysed by language. Based on that conceptualisation, we develop a two-dimensional learning field for heuristic strategies, identify possible learning paths within, and give an analysis of established design elements of HWEs (e.g. Renkl, 2017), such as self-explanation prompts and fictional dialogues, regarding these learning paths.

The presented theoretical framework can be used to identify and develop new (configurations of) design elements for HWEs, and to formulate more general design principles, hence as a basis for evaluating and developing learning material. It also serves as a theoretical foundation for specific empirical research questions and hypotheses, e.g. regarding the effect of specific, known and new (configurations of) design elements and principles on the learning of heuristic strategies. In that manner, we are currently conducting individual case studies with a heuristic worked-out example including self-acting tasks and post-reflection tasks as new design elements.

References

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