PROBLEM-SOLVING SKILLS TO OPTIMISE GEOMETRIC CONCEPT DEVELOPMENT

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How do students develop geometric concepts? Does a web-based lexicon with representations of objects, supported by a step-by-step problem-solving approach and Cinderella software, initiate a process of concept development?
'Pictures' (photos), the first level in the instructional design theory described by Seel and Winn (1997), are directly related to the simulated object. The second level, called 'figures', consists of drawings that help create or transform mental images and activates visual reasoning as in the description of external representations (Gutiérrez, 1996). Theoretical representations are components of the third level, named 'symbols'. The natural growth in this conceptual process of thinking is determined by empirical abstraction focusing on objects and their properties, pseudo-empirical abstraction focusing on actions, and reflective abstraction focusing on properties and the logical deduction (Tall, 2004). Cinderella software activates the development of a pseudo-empirical abstraction process because it enables student's further exploration. Problem-solving skills are based on the Heuristic Mathematics Education approach (Van Streun, 1989).

Data were analysed by categorising catchwords in three levels of argumentation: colloquial language, formalized language, and logic (Van Hiele, 1986). Progress in concept development was difficult to establish because of the type of problems (only application problems). The number of correct step-by-step solutions has increased (process). Animations at the second level took too much time, so students didn't use the lexicon sufficiently (product). Teachers didn't support students by indicating other representations at the same level, nor at another level through switching (teachers' role). Students preferred alternating computer-based collaborative work with teacher-centred learning activities.

References

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