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Prospective mathematics teachers' technological pedagogical content knowledge of geometry in a GeoGebra-based environment

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2017

http://hdl.handle.net/10539/23662

Ramatlapana, Kim Agatha (2017) Prospective mathematics teachers' technological pedagogical content knowledge of geometry in a geogebra-based environment, University of the Witwatersrand, Johannesburg, <http://hdl.handle.net/10539/23662>

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ABSTRACT

This research study focused on exploring prospective teachers' knowledge of geometric reasoning in teacher preparation. Premised on the claims that learning mathematics is profoundly influenced by the tasks, by the learning context and by the tools that are used in mathematics instruction, mathematics prospective teachers' technological pedagogical content knowledge was examined. The technological pedagogical content knowledge (TPACK) framework was employed to study the prospective teacher's knowledge of circle geometry as proposed by Mishra & Koehler (2006). The main focus of the research was on investigating the empirical and theoretical questions of what characterizes aspects of prospective teachers' technological pedagogical content knowledge. These aspects were geometry content knowledge (CK), geometry pedagogical content knowledge (PCK) and geometry technological content knowledge (TCK). This exploratory multiple case study explores the TPACK of six mathematics prospective teachers enrolled in a second-year undergraduate mandatory mathematics methodology course in an urban South African university. Data was collected through prospective teachers' (PTs) responses to circle geometry tasks, interviews and screen cast recordings. Rubrics were employed as analytical tools. Duval's (1995) cognitive apprehensions and processes were engaged as interpretative tools to understand how the PTs responded to the CK, TCK and PCK tasks. The results suggest that prospective teachers' circle geometry technological pedagogical content knowledge constructed in a GeoGebra-based environment is characterized as weak emanating from weak geometry content knowledge (CK), weak technological content knowledge (TCK) and weak pedagogical content knowledge (PCK). The study has shown that a weak geometry CK was evidenced from the participating PTs' weak display of cognitive apprehensions and geometry reasoning processes. This study contributes to the current debates on teacher professional knowledge and on an understanding of frameworks for which teacher knowledge can be premised in South Africa. A model was developed for classifying and describing forms of mathematics connections in geometry knowledge at teacher preparation level.