

Abstract

This mixed-methods study drew from the social constructivist perspective and the Theory of Semiotic Mediation (TSM) (Vygotsky, 1978) to develop a pedagogical framework that supports the integration of ICTs in the teaching and learning of probability. The study investigated the impact of the use of GeoGebra on Grade 10 learners' understanding of probability. It sought to find ways in which GeoGebra can be used to overcome specific challenges Grade 10 learners have when solving probability problems. The research site was a school in Gauteng Province in Johannesburg, South Africa. Two groups of Grade 10 learners, the treatment group ($n = 14$) and the control group ($n = 22$) were taught in probability content for three weeks using standard instructional practice. No technology was used in this phase, but student-centred strategies which support active learning and interaction were adopted. Participants then wrote a pre-test covering probability concepts. Before writing the post-test, the treatment group received remedial intervention using GeoGebra, while the control group was taught without technology. The pre-test and post-test were quantitatively analysed using error analysis. Qualitative data were collected through participant observation and semi-structured individual interviews. The study found that the use of GeoGebra significantly reduced item difficulty levels and increased the incidence of use of correct methods in problem solving. Furthermore, it contributed to creating an active learning environment in which learner misconceptions were addressed. The findings highlight a teaching framework that can be used to leverage the potential of errors to support learner understanding of probability. We conclude that the semiotic potential of GeoGebra creates a learning environment where learner misconceptions in probability are resolved.