

MATHEMATICS, TECHNOLOGY INTERVENTIONS, AND PEDAGOGY – SEEING THE WOOD FROM THE TREES

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This research explores recent technological interventions in mathematics education and examines to what extent these make use of the educational opportunities offered by the technology and appropriate pedagogical approaches to facilitate learning. In an attempt to answer this question, a systematic literature review has been carried out, and a classification is presented that categorises the types of technology as well as the pedagogical foundations of the interventions in which those technologies are used. The potential of technology to fundamentally alter how mathematics is experienced is further investigated through the lens of the SAMR hierarchy, which identifies four levels of technology adoption: substitution, augmentation, modification and redefinition. The results of the research will be beneficial for guiding teaching in a technology rich environment, offering the potential to improve mathematics education.

Keywords: Mathematics Education; Technology; Classification

The aim of this research is to gain some clarity regarding pedagogical approaches to technology interventions in post-primary mathematics education, as documented in recent literature. The objective is to increase the understanding of the kinds of teaching and learning of mathematics that technology has the potential to enhance and to develop a set of guidelines that exemplify this practice. A long-term goal is to create, and test, a comprehensive 21st Century model of classroom practice for mathematics education.

Existing classifications of technology for mathematics education were investigated, with the selection of two papers (Hoyles & Noss, 2003; Hoyles & Noss, 2009) to provide the foundation for the technological aspect of the system used in this study. Classifications of technology adoption were also reviewed, with the SAMR hierarchy (Puentadura, 2006) perceived as being the most appropriate lens through which to classify interventions described in the literature. In addition to grouping the interventions by technology and by levels of adoption, this research also classifies them according to learning theory (behaviourist, cognitive, constructivist, etc.) and instructional approaches (drill and practice, active learning, sense making, etc.).

The literature was selected using the search terms *math* AND (technolog* OR tool*) AND education*, with the results refined by limiters such as *secondary education* and date: *2009 – 2012*. The electronic databases searched for the review were chosen for their relevance to education, information technology and mathematics: ERIC

(Education Resources Information Center), Science Direct, and Academic Search Complete. Data emerging from the literature review were coded and stored in a spreadsheet pivot table. This allowed the information to be arranged and visualised in diverse and meaningful ways, contributing to the development of a system of classification for technology interventions in mathematics education.

From this classification, a set of guiding principles for the appropriate use of technology in mathematics education was extracted. The guidelines describe the conditions under which mathematics teaching through the use of technology is believed to have the greatest potential for success.

The emerging set of guidelines point to a holistic perspective on technology interventions in mathematics education. They emphasise a collaborative and team-based approach, in accordance with socially constructivist learning theory. Both the transformative and the computational capabilities of diverse technologies should be taken into account, providing for the investigation of challenging and interesting problems and the development of flexible and creative solving strategies. The summative and/or formative assessment potential that technology offers needs to be utilised to encourage successful integration. Innovation with regard to the working environment and class routine are seen as necessary in order to fully exploit the potential of technology in the teaching and learning of mathematics.

The poster presentation will be made up of diagrams to illustrate the data from the literature review, as well as descriptions and illustrations of interventions designed in accordance with the guidelines.

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