

DESIGNING INTERACTIVE TOOLS THAT ENGAGE MATHEMATICAL LEARNERS

Jim Pettigrew, Donald Shearman

Presenting Author: Donald Sherman (d.shearman@uws.edu.au)
Mathematics Education Support Hub, University of Western Sydney, Penrith NSW 2751, Australia

KEYWORDS: mathematics, interactive, engagement, learning object

ABSTRACT

Student engagement is a common factor in all constructivist models of mathematical learning. For learners to find their way into a mathematical problem and build their own understanding of its representations and relationships, they must be motivated to observe, interact with and make sense of its conceptual and computational elements. This study examined the development of a suite of interactive online learning tools that targeted specific curriculum areas of first-year mathematics at the University of Western Sydney (UWS). Its aim was to describe the design principles, processes and decision-making involved in creating these tools, and to set this in the context of a broad review of the higher educational use of digital learning technologies.

The technical and pedagogical dimensions of web-based educational application design are vast and complex. But while new innovations pop up almost daily to expand the capability and reach of such applications and improve their performance, the principles of effective visual communication and 'digital pedagogy' change less rapidly. This relatively stable research base has allowed the authors to select a particular combination of technologies (Processing, JavaScript and HTML5) and focus their application development on the interplay between interface and 'best practice' pedagogical design. The following questions were considered: which mode of delivery of the learning tools (online, mobile app, executable app) would best suit the learning needs and circumstances of mathematics students at UWS?; which mode of delivery would allow for the most rich, accessible and visually appealing application development?; why would direct manipulation of an application's interactive elements improve students' engagement with and comprehension of the featured problem?; does this kind of 'hands on' facility help to make abstract mathematical concepts more concrete (and if so, how)?; what are the risks associated with using misleading or over-designed/engineered representations in graphically-driven digital learning tools?; and why would a dynamic, interactive interface be superior to a static interface in allowing students to construct their own meanings from the featured problem?

Among the many approaches used to engage mathematical learners, the use of specialised interactive tools designed to address particular curriculum areas presents new challenges and opportunities to educators. This study examined the fruits of a project whose purpose was to meet these new challenges and exploit these new opportunities.

Proceedings of the Australian Conference on Science and Mathematics Education, University of Sydney, Sept 29th to Sept 30th, 2014, page 70, ISBN Number 978-0-9871834-3-9.