Learning Mathematics Online

A Review of the Literature

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ETEC 500: Research Methodology in Education

University of British Columbia

Master of Educational Technology
1.

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Needs

As the technologies of Western Societies continue to accelerate at exponential rates, educational institutions are feeling the need to keep pace. As a result, the number of online courses taught in Virtual Schools continues to grow in all areas of education. By 2005, the National Center for Educational Statistics reports that approximately one-third of public school districts will have students enrolled in online courses (Er, 2008). Parents who home-school their children doubled in the years 1996-2003 (Er, 2008). These same homeschoolers are increasingly turning to virtual schools. (Roblyer, 2006). Home-schooling parents believe that “they should be highly active in their child’s education, be able to be effective in teaching their child, and have the contextual support necessary for teaching their children” (Green and Hover-Dempsey, 2007)

The need for these distance education options in secondary schools stems from numerous factors. Many school districts suffer from a lack of qualified teachers (Chaney, 2001), especially in Math. Small school with lower enrolment numbers are continually challenged to offer high end Math electives like Calculus. The perceived conflicts between religious beliefs and public school programs (Cooper and Sureau, 2007), peer impact (Ray, 2000), physical or mental health problems or other special
needs of students (Isenberg, 2007) are cited as additional factors inherent to the growth of distance education online course offerings.

The number of non-traditional students in secondary schools has also fuelled the growth of online courses (Rice, 2006). Students in remote locations, along with students involved in high end athletics and performance based activities are not able to attend classes regularly. Illness, lack of transportation, the need to work to help support the family, numerous environmental and social benefits (Saba, 2005) all contribute to the growth of online courses. Student motivation for online courses may contribute to learning (Er, 2008), while the asynchronous element of [on-line learning] opens educational opportunities for students with varying backgrounds and experiences (Galminas and Autrey, 1999).

Technology

While the need and growth of online math courses is clearly increasing, the technology and expertise required to deliver quality programs has offered some challenges. Instructors need strong math pedagogy, but also require sufficient training and expertise at setting up online courses. A requirement that would professionalize virtual schooling would be for online teachers to have subject certification and an online teaching endorsement (Cavanaugh, et al., 2006). Galminas and Autrey (1999) strongly
encourage anyone developing an online course or program to get some training. The platform to deliver the course needs to be carefully examined, and there must be sufficient technological support. For example, Galminas and Autrey (1999) found the Top Class course management software to be somewhat inflexible, but found Blackboard to be more user friendly. Cost is another factor. Bedore (1997) reports complete course development costs to be over $2000.

From the student’s point of view, research shows perceptions to be mixed. Some students refrain from online learning simply because it is new or different. The process of writing math equations is usually very challenging and time consuming for the majority of students (Akelbek, 2009). Similarly, Smith et al. (2002) reports that current based web-based distance learning environments do not directly support formulas and diagrams. There is the issue of diagrams as they are used to convey layered abstract concepts to students. The lack of adequate or affordable internet service, computer hardware, or meaningful tech support are other factors that students may encounter as barriers.

Of course, many of these issues can be overcome. Math-Type is a mathematics equation editor that easily allows math symbols to be added to any online document. Graphing Calculators are readily available, and the accompanying Graph Link software allows communication between calculator and computer (Galminas and Autrey, 1999). Russell and Holkner (2000) suggest that technology provides “inexpensive synchronous
and asynchronous multimedia, delivered cheaply any place any time”. In a report where Net Tutor software was used, most participants had little or no difficulty understanding how to use the tools, and most found them easy to use (Smith et al., 2002). Akelbek (2009) report that in their work, students don’t need to have sophisticated technology, simple knowledge of a computer is sufficient to complete the course. Whatever the technological difficulties that students may face, the tracking of the history of math on the web shows that these problems are being overcome at an accelerated pace (Bouniaev, 2004).

**Drawbacks**

As noted, some of the drawbacks of learning Math online can be attributed to delivery and infrastructure costs, and the problems inherent to the particular technology used. Student motivation has been cited. Some students suggest that learning math online is more difficult because they perceive math to be more difficult than other subjects (Moor and Zazkis, 2000). Others state the lack of face-to-face contact with a teacher was a real problem (Galminas and Autrey, 1999). The fact that students have less interaction with the instructor is one of the negative factors in online learning (Saba, 2005). No one will argue that bad teaching is bad teaching, whether it is in a conventional classroom setting or online. Every form of education is likely to display drawbacks for some particular user groups.
Benefits

The number of Virtual Schools, online courses, and Web-based instruction continues to grow. Such a phenomenon is rooted in the notion that online courses offer substantial benefits to online learners. Flexibility, clarity, and feedback mark some of the gains experienced by online learners.

Convenience is the most important benefit perceived by students of the asynchronous online delivery format. (Chao and Davis, 2007). The lack of time constraints gives students an opportunity to digest material and relate it to their own experiences (Galminas and Autrey, 1999). The fact that learners have control of their own pace showes benefit to some learners (Saba, 2005). Not only do student’s benefit from the pace of their own learning, when they learn is also under their control. Students appreciate the flexibility of course access at any time and in the comfort of their home (Chao and Davis, 2007). Even teachers, with busy schedules and hectic lives can greatly benefit from a learning environment that provides just in time development throughout the day and week (Saldivar and Jolly, 2002).

Instructions and all deadlines and due dates can be clearly posted. Students can go back through lecture video and follow examples again and again if needed. Akelbek (2009) report that the most significant factors that contributed to student success of the online math courses were recorded lectures. Students can collaborate in a small group, or can work alone as they chose. There may be increased parental involvement.
Virtual schools have brought new role combining the features to parents, grandparents and in general to whoever guides the student’s instruction at home (Er, 2009).

Feedback and assessment are key aspects of any successful educational model. With an online course, the teacher’s role has changed from serving as a source of knowledge to being a facilitator or a guide to his or her students (Huerta, d’Entermont and Gonzalez, 2006). Responding to student’s questions in a short time gives them an opportunity to focus on the learning process (Akelbek, 2009). Models of assessment vary. Some courses use online assessment, short answer and multiple choice where the program marks it and gives immediate feedback. Other course have students email their work to the instructor, or use a proctor for final exams. One of their findings is that virtual school students are more likely to show high academic achievement and perceive a greater level of teacher support (Er, 2009).

The benefit of online learning continues to expand. There are lots of online resources, links to YouTube, CNN, or NASA, that can be built into most courses to enhance motivation and all other aspects of learning. Students like the novel idea of learning online or learning in a different way. The use of social networking like Facebook, Twitter, and LinkedIn has not been studied but may have significant beneficial factors when incorporated in online learning. We find ourselves amid the reform of online learning. Such reform in educational systems improves the equality of
access and ultimately provides opportunity for educational mobility with effective student learning (Saba, 2005)

So how do several small, semi-rural schools in the Interior of British Columbia provide this equality of access to a limited number of students who require the educational mobility of Calculus for University entrance? Can the benefits of online learning, despite the technological and economic limitations, be exploited to offer the most favourable learning environment possible? Clearly there needs to be some research conducted on this topic.
References


