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Paper Title Bridging Algebra Learning With Online Platforms Anchored in Web-Based Multimedia Video Cases of Classroom Teaching in Singapore

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Title: Bridging Algebra Learning with Online Platforms Anchored in Web-based Multimedia Video Cases of Classroom Teaching in Singapore

Purposes

Using the ‘model method’ (drawing rectangular diagrams to visually represent and analyze quantitative information in a given word problem) in elementary schools (from ages 9-12) in Singapore is believed to have enabled most Singaporean children to solve mathematically very challenging problems (Beckmann, 2004; Ng, 2004). Yet, by emphasizing concrete arithmetic thinking through this approach, students’ ability to transition to abstract algebraic thinking could be hindered (Looi & Lim, 2009; Ng & Lee, 2009; Stacey & MacGregor, 2000). Under this context, a set of multimedia video cases was developed from a unit of 6th-grade lessons on fractions word problems in which the case teacher attempted to bridge arithmetic and algebra learning through the “model method”. In this paper, we aim to present an online learning environment designed to anchor teachers’ knowledge and community building in this set of multimedia video cases to address issues surrounding bridging in Singapore. We intend to share our design rationale, elements and research findings from implementing our design in the case teacher’s school to inform our iterative design cycles. Three research questions were targeted: first, what constitutes and how to design educative video cases for teacher learning? Second, what constitutes and how to design and implement an effective online platform for teacher learning anchored in video cases of teaching around bridging issues in Singapore? Third, how do we know whether there is knowledge and community building going on in the implementation?

Theoretical framework

Classroom teaching consists of complex streams of conversations, actions, interactions among teachers, students, and the subject matter (Ball & Cohen, 2000). Faced with complex classroom situations, diverse students and diverse teaching contents, a teacher needs to develop the ability to construct his/her knowledge in many possible ways so that he/she can make suitable adaptation when the situation changes (Spiro et al, 2003). Many believe that such knowledge is embedded in cases and can be learned by interpreting through the situation in which the case lies in (Putnam and Borko, 2000; Shulman, 1992). Learning through cases situates the learning in the authentic context of teachers’ daily work (Cobb & Bowers, 1999) and successful learning happens as a result of “contributions of the individuals who participate, along with tools and artifacts” (Greeno et al, 1996, p. 20) in learning communities.

Therefore, purposeful life-long learning in teacher professional learning communities are characterized by ongoing deliberations on the dynamic tool-mediated interactions in teaching and the social construction of knowledge (Brown, Collins & Duguid, 1989; Borko, 2004; Fullan, 2001). To nurture such learning communities, online technologies can break down barriers that “divide personal, social and contextual conditions for learning” in the busy work lives of teachers and allow “flexibility for when and how learning occurs” (Hoban, 2002, p. 149). Video cases can provide video clips of authentic representation of classroom situation;

along with interviews with teachers, student work and assessment, they build resources for “high leverage practice” (Hatch & Grossman, 2009) for teachers at different stage of their careers. More recently, multimedia video technology and internet-based video streaming have become effective tools to “preserve the messiness and ambiguity of teachers’ daily work” in visually effective cases (McGraw et al, 2007, p. 96) and engage teachers in pedagogical reasoning (Nemirovsky et al, 2005; Schrader et al, 2003) and develop their eyes to “notice” what is important in teaching and in the course of those dynamic interactions (Sherin & Van Es, 2005). We envision our design of a learning system consisting of dynamic interactions between teachers as learners, their learning activity, the cases as tools, set against the simulated environment of teachers’ workspace.

Design and research methods

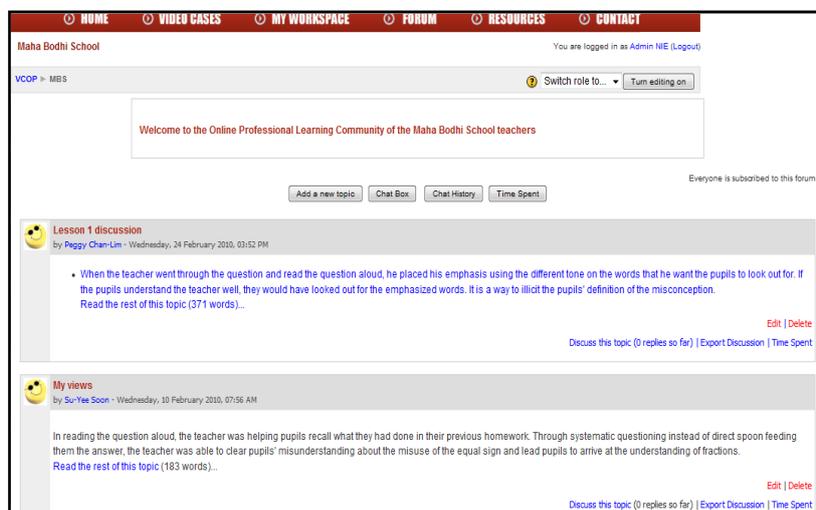
Design methods and components

As an integral part of research, developing video cases and online learning environment usually faces numerous challenges, such as time and funding constraints, tedious editing processes, the need to develop storytelling and attend to the quality of the content (Liedtka, 2001; Stephens et al, 1999). Therefore, information regarding methods of design is largely missing in the research literature (Stockero, 2008). Research related to online learning community has covered how to design an online platform for mathematics teacher learning and what kind of impact it has on mathematics teacher learning (Burgess and Mayes, 2008; Koc et al, 2009; Stephens and Hartmann, 2004) but we do not yet have a holistic picture of and specifics involved in designing, operating and evaluating an online learning community, not to mention sustaining one. These questions remain to be explored to help us understand how to build mathematics teachers’ knowledge and in what ways online technologies can promote their knowledge.

Based on review of prior research and our theoretical framework, our design followed the principle of authenticity, such as formulating the problem around the dilemma of bridging facing the local context, choosing video material from regular classroom teaching and use interviews with the case teacher to give a first-person narration of his rationale for planning, teaching and assessment. We identified video clips capable of engaging teachers in reasoning about a given situation (Boaler & Humphreys, 2005) and designed scaffolds with viewing questions and template to engage teachers in describing and analyzing given situations in terms of what is noteworthy in content, instructional goals and student understanding as well as how the teaching relates to their own practice and broader principles of teaching and learning (McGraw et al, 2007; Van Es and Sherin, 2002a; Sherin & Van Es, 2005).



Simplicity for use guided the design technology so we were able to give our focal attention to creating person-video and person-person social interactions mediated by technology (Barab et al, 2003). Teacher participants responded to the scaffolds or prompts in video cases through video streaming in the blogs that we call, My Workspace (as shown in the third icon in the above figure). Meanwhile, they were also encouraged to raise their own issues for discussion by identifying and sharing in the Forum Space (the fourth icon in the above figure) what they think as critical incidents (such as difficult, important and hinge points of teaching and learning) (Paine, Fang & Wilson, 2003) in a video, see the figure below. For ease of use, a ‘Share’ button (the icon at the right bottom below the writing pane in the above figure) merge the above two spaces together, that is, by clicking on ‘Share’, their responses to the viewing questions each time are automatically archived in My Workspace and simultaneously become an entry in the Forum for sharing and discussion with other participating teachers.



Online group interactions do not always “happen” spontaneously; they require care and nurturing by way of facilitation (Schifter, 2010; White 2004). To foster online sharing in the asynchronous communication, mathematics teacher leaders (including the case teacher) acted as facilitators (Stephens & Hartmann, 2004) in the case teacher’s school by providing feedback, encouraging participation and building depth in the discussions (Wang, 2008).

Research methods, data and analysis

In research, we focused on two interrelated dimensions: we studied the design to see whether it was effective in supporting teacher learning and to inform our ongoing iteration of design cycles for continuous improvement. In the meantime, we followed up closely teachers’ use of the video cases in the online environment to find out whether there is learning, knowledge and community building going on. We coded the archived responses to viewing questions in the blog and discussion threads in the forum to determine the level of involvement and reflection from response patterns, online participation structure and discourse, and the role of facilitation in sharing and building knowledge. With our built-in regular online surveys on perception and behavior of tool use, and face-to-face interviews with sampled teachers, we were able to triangulate the analysis and obtain rich information to describe the learning and community building.

During the on-going support of the online learning, data collection and analysis, we were aware of the complicated dual roles we played as designers and researchers of our design. Hence we had to remain both committed to our ‘invested agenda to provide service to that community’ (Barab et al, 2003, p.239) and critical towards constructing an objective ‘thick description’ (Geertz, 1983, cited in Barab et al, 2003, p. 239) of our collaboration in fostering a community life.

Results

Our analysis shows that authenticity and careful design informed by systematic review of design theories and earlier research as well as ongoing teacher feedback was a key factor in promoting the initial success in knowledge and community building. With lessons from real classrooms of one teacher’s self-initiated attempt at bridging to “offer my pupils the best of both worlds (arithmetic and algebra through the model method)” (interview with the case teacher), a perennial learning issue worldwide was thus represented in ways to capture the unique local problem and thus was able to trigger rich discussions. From teacher responses, we found that, by describing the teaching situations and interactions in the video cases and then relating to and trying to apply in their own practices, they were making serious effort to understand a colleague’s teaching and reflect on their own. Including the case teacher’s interviews in the video cases and having him play the role of a facilitator and co-participant in the Forum also helped other participants to make better sense of his thinking, realize what was going on behind the classroom scenarios portrayed in the video cases and verify the truth

of the claims they make about the video case (Koc et al, 2004; Lu & Jeng, 2006) in the online forums.

The learning resources tailored to the needs of teachers and feasible to overcome time and space constraints saw quick adoption by the school leaders. This became the other positive indicator of the initial success of implementation – the school's a strong sense of ownership. The school administration organized face-face sessions led by the case teacher during the weekly contact time to familiarize teachers with analyzing the video cases offline before moving them to the online environment. In doing so, an ideal blended version of implementation was formed. In the later half of the year, the school tried out the bridging practice of the case teacher across the 5th and 6th grade classrooms since they started to share the same belief – if their students are capable of choosing between the model method and algebra approach in solving given word problems, they would be at a good advantage in the Primary School Leaving Exam (PSLE). More detailed findings will be presented in our paper.

Significance of the study

Our research, development and implementation experience strongly illustrates the importance of research-based development of tools and processes to inform practice and policy. Since such study has an immediate concern about its impact on practice, we strive earnestly to generate good solutions to practical problems in teaching and learning. As Schonfeld (2006) advocated, we built on findings from earlier research but, we have gone beyond them, by building and implementing a prototype platform and tools for teacher learning in Singapore. We continue to conduct rigorous evidence-informed evaluation to help inform and sustain the knowledge and community building effort in addressing the bridging issues. Further implementation and research is going on in a follow-up funding cycle to drawn on implications of use in diverse school contexts and learning platforms (such as formal online courses). In the meantime, we have to face the widely-acknowledged challenges in conducting such time-consuming and long-term projects that commonly have a longer waiting time to yield data for academic sharing purposes. However, with our firm belief in its value for creativity and its direct application to improve practice, we strive on. (*Word count:1941 words total*)

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