CREATING A SOCIAL ECOLOGICAL MODEL FOR ELEMENTARY MATHEMATICS HOMEWORK

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Research suggests that it is not simply time spent on task, independently completing mathematics homework, but rather purposefully designed, engaging homework activities, completed in specific social contexts, that helps students to achieve academic gains. In this study, two urban teachers share their use of blogs and discussion forums to communicate with parents and to help facilitate mathematics discourse with their students. The teachers highlight challenges with the age group ten to twelve and their access or use of technology in the home, or with the support of their parents.

Keywords: Middle School Education

Introduction

Homework is utilized by many professionals to communicate with parents, to increase student time on task and is believed to improve student achievement (Trautwein, 2007); despite a lack of consistent empirical evidence (Rønning, 2011). The National Council of Teachers of Mathematics (NCTM, 1980) suggests the sole purpose of mathematics homework is to productively extend student engagement (Landers, 2013); therefore, educators and administrators must plan homework tasks carefully to ensure students are actively engaged. Although the completion of homework has been shown to increase understanding and retention of academic material (Zimmerman, & Kitsantas, 2005) and a relationship exists between time on task and academic achievement (Trautwein, Köller, Schmitz, & Baumert, 2002), there is still a lack of strong empirical support. Considerations regarding instructional design (Epstein & Van Voorhis, 2001; Marzano, & Pickering, 2007; Van Voorhis, 2010), in addition to the social context in which students complete their homework (Landers, 2013), provide insight towards a homework-achievement relation and provide a rationale for contradictory results in homework gains. If research can suggest that it is not simply time spent on task, independently completely mathematics homework, but rather purposefully designed, engaging homework activities, completed in specific social contexts, results may prove to be more consistent.

The purpose of this study is to investigate the potential impact computer- supported collaborative learning (CSCL) environments have in developing mathematical discourse. The present study is guided by the following questions: (1) How do teachers' of students (aged 10-12 years) use online asynchronous communication tools in mathematics to facilitate discourse? (2) What evidence exists to support the argument online asynchronous communication tools in mathematics increase students' (aged 10-12 years) engagement in mathematical processes?

Theoretical Framework

Research on homework interventions in mathematics have considered multiple variables regarding the homework achievement equation such as: using selected homework strategies (i.e. real life contexts, homework planners) (Bryan, & Burstein, 1998); frequency of homework assignments (Trautwein, Köller, Schmitz, & Baumert, 2002); student perception of the purpose of homework (i.e. practice, preparation and extension) (Rosário, Núñez, Vallejo, Cunha, Nunes, Mourão, & Pinto, 2015); mother's level of self-efficacy in mathematics (Hyde, Else-Quest, Alibali, Knuth, & Romberg, 2006); student self-regulation (Zimmerman, & Kitsantas, 2005); family involvement (Van Voorhis, 2010) and parental monitoring (Sirvani, 2007).

Galindo, E., & Newton, J., (Eds.). (2017). *Proceedings of the 39th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education.* Indianapolis, IN: Hoosier Association of Mathematics Teacher Educators.

School-family partnership programs are one approach for educators to address inequalities amongst their mathematics students (Hyde, Else-Quest, Alibali, Knuth, & Romberg, 2006; Patall, Cooper, & Robinson, 2008; Sirvani, 2007; Van Voorhis, 2010). Based on earlier beliefs regarding the utility of homework, homework frequency and time on task, it is generally accepted that homework begins in elementary school and grows in difficulty, based on a student's ability to work independently and regulate their time (Zimmerman & Kitsantas, 2005). Younger students are less likely to be efficient or successful when working independently (Rønning, 2011). Whereas middle school students perform better on homework tasks when they perceive a sense of control and autonomy, away from the scrutiny of their parents (Núñez, Suárez, Rosário, Vallejo, Valle, & Epstein, 2015). Therefore, a small window of opportunity exists in the elementary grades for a school-family partnership to yield positive results related to homework and academic gains.

When students perceive a purpose for their homework they are more inclined to become engaged. Research suggests, a purposeful design of engaging homework is more effective than simply increasing time on task (Van Voorhis, 2010; Epstein & Van Voorhis, 2001). In a recent study of 638 grade 6 students, Rosário et. al., (2015) examined the effect of homework purposes on mathematics achievement. Of the three homework purposes, extension was found to have a positive impact on achievement, while practice and preparation did not. Purposeful design of homework, that ensures student engagement and extension in mathematics, is of great importance for teachers and school administrators (Rosário et. al., 2015).

It is of the utmost importance that schools approach families in a targeted attempt to improve "children's exposure to math-relevant experiences" (Galindo & Sonnenschein, 2015, p. 25). Without this intervention, children from low SES families are unlikely to "develop sufficient math skills to be competitive in today's technological world" (Galindo & Sonnenschein, 2015, p. 25). Furthermore, Jorgensen, Gates, & Roper, (2014) strenuously point out that it is important to understand the "wider set of social practices" (p. 221) in mathematics education by considering cultural backgrounds, dispositions of learners and learning environments. In many aspects, a child's ability in mathematics, sometimes evident as early as kindergarten, is not under the control of the teacher or the school (Jorgensen, Gates, & Roper, 2014), but rather, is shaped by their social background (Jorgensen, Gates, & Roper, 2014).

Background Information

As the primary investigator, and in my role as a Grade 7 teacher, I had daily contact with 75 grade 7 students for a period of 4 months between March 2016-June 2016. The students participated in a daily math journaling activity over the course of 8 weeks between April 2016- June 2016, along with 6 other teachers in the school who were also engaged in a math journaling activity with their respective classes. The purpose of the journaling activity was to increase mathematics discourse and time devoted to developing the mathematical processes. At the start of the 8-week period, the students were invited to participate in a goal setting activity related to mathematics and academic gains. Of the 75 participants, 26 completed the goal setting activity (0.347) and together submitted 66 goals for the 8-week period. Content analysis of the goals identified by the participants provided evidence that 14 of the 26 students (0.538) specifically referenced the word "homework" in their goal setting and perceived mathematics achievement gains to the timely completion and utilization of mathematics homework. Although other goals were cited (staying on task and asking more questions during class), homework is identified as the only activity related to academic gains in mathematics outside of the classroom.

Discussion

The idea to consider the relevance of homework within the parameters of the study, using online asynchronous communication tools to communicate with parents and students regarding homework (problems of the week, discussion topics) emerged as a promising focal point for the second year. At the close of the first year of study, and after analyzing the results of the previous mathematics journaling activity, five discoveries were made that impacted the direction of the study:

- Grade 7 students believed utilization of homework was related to academic gains in mathematics
- Grade 7 students believed improving their homework habits would produce academic gains in mathematics
- Grade 7 students believed they were in control of their academic gains in mathematics
- Grade 7 students believed academic gains in mathematics were directly related to their ability to self-regulate their time and attention
- Grade 7 students believed their home environment was not a barrier to their academic gains in mathematics

In the fall semester of 2016, semi-structured interviews were used to investigate six urban mathematics teachers who used technology to engage their mathematics students in discourse. The initial interviews lasted 60 minutes in length and provided a baseline to understand the teacher's background, familiarity with the technology and the teacher's motivation and intent for using CSCL to communicate with parents in the home and facilitate mathematics discourse with their students outside of the classroom. Of those six interviewed, two were selected based on their use of technology with their students, the age of their students and their motivation for participating in the study.

Veronica was chosen to participate in the second year of the study because she teaches mathematics to grades 3 and 4 with a heavy emphasis on asynchronous technology to communicate with parents and uses parent involvement to productively extend and engage her students in homework. Although Veronica is still struggling to think outside of the box for questions about mathematics and how to generate discussions about concepts students are learning, her acknowledgement and willingness to develop literacy or understanding in in Mathematics makes her an ideal candidate. Veronica has pre-established routines and a solid parent-school relationship that was developed before her participation in the study. The addition of a mathematics focus will be challenging for her but beneficial. Jeff is an ideal candidate because he teaches grade 6 students, who are preparing for a provincial assessment test in June. The additional pressure of performing well on an achievement test will increase his students' motivation and the motivation of their parents to be involved in additional practice and homework in mathematics. At my suggestion, Jeff has included a discussion focus for the PATs where students share concerns about the upcoming test, questions they have, and as a general resource for websites or materials other students have found helpful.

Follow up interviews are ongoing throughout the current school year to discuss challenges faced this year. It is hoped in the second year of the doctoral study, specific findings will be made related to the use of online asynchronous communication tools for engaging both parents and students in mathematics discourse, by identifying challenges related to:

- Engaging students in mathematics
- Communicating with parents about mathematics learning
- Assigning mathematics homework at the elementary level

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