

How Does Skype, as an Educational Tool, Contribute to Elementary Math Teachers' Reported Level of Self-efficacy?

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Abstract: How does Skype, as an educational tool, contribute to elementary math teachers' reported level of self-efficacy? A sample of n = 16 teachers was purposefully selected to use Skype in their classrooms with a webcam and microphone to communicate with other math teachers and math mentors. The findings revealed that teachers viewed Skype as an educational tool that contributes to the increase of their self-efficacy, which may increase students' performance in state math testing. Institutes of higher education, professional development providers, teacher organizations, school districts, and math leaders may benefit from having an awareness of how online communication software such as Skype can increase elementary math teachers' efficacy in the field of teaching and learning. Teacher self-efficacy can be increased through opportunities for ongoing discussions with other math teachers and especially math mentors in the school or within the school district. Supporting math teachers through Skype's features such as video and voice calls, sharing of files, and sending and receiving instant messages is important for teachers' sustained growth; however, online teaching support needs to be intentional, ongoing, and systematic.

Background of the Problem and Nature of the Study

State math scores of elementary math students at the participating data site indicated that student achievement has been below proficient levels for over seven academic years. The problem is that elementary math teachers' reported self-efficacy has not been examined at the data site. Knowing how Skype, as an educational software tool of communication, can contribute to elementary math teachers' reported level of self-efficacy may assist school districts in integrating online communication programs to support math teachers and math mentors, and as a result to increase student performance in state math testing. This qualitative case study sought to answer the research question: How does Skype, as an educational tool, contribute to elementary math teachers' reported level of self-efficacy?

Purpose of the Study

No research has been conducted in the participating district at a district-wide level with the intention to provide online support to elementary math teachers that may contribute to their reported level of self-efficacy. The purpose of this study was to examine whether or

not a software program such as Skype can assist math teachers in professional development in terms of receiving instant support from math mentors online via video and voice calls and sharing of files to contribute to teachers' level of self-efficacy. Current literature review revealed: (a) students benefit when teacher effectiveness increases, (b) teachers have the ability to work more effectively with students when they have a higher sense of self-efficacy, and (c) teachers with a higher sense of self-efficacy can influence students' motivation, and as a result, influence student achievement. The findings of this study may encourage math teachers and mentors, school and district administrators, and policy makers to support the integration of online communication software into the professional development of math teachers through (a) video and voice calls, (b) sharing of files, and (c) sending and receiving instant messages in order to sustain teachers' professional growth.

Theoretical Framework

This study was grounded in the Self-Determination Theory (SDT), which is a theory of motivation that has its basis in the assumption that behavior is motivated by autonomy, competence, and relatedness (Deci & Ryan, 1991; 1985; Ryan & Deci, 2000). SDT presupposes that when individuals freely choose to participate in activities, without external pressures, they are fulfilling the need for autonomy. In addition it is assumed that when the subject is engaged, the subject will further develop ability in the action and along with that confidence in their ability to perform. The resulting subject's perception of higher levels of competence and self-determination then leads the subject into a state of higher motivation (Deci & Ryan, 1991/1985). This study was also grounded in Bandura's (1977) social-cognitive theory that a person acts as an agent for self-development, adaptation, and self-renewal. Bandura suggested that various inputs, particularly mastery experiences, could lead to greater teacher confidence. The perception of one's ability affects one's thoughts, feelings, motivations, and actions.

Assumptions, Limitations, Delimitations, and Scope

The assumptions that guided this study consisted of ideas related to the qualitative case study methods approach. The researcher assumed that the participants were teaching math courses and were not assigned to other roles and responsibilities by the school district.

The limitations of this study are the potential weaknesses in the study. The findings of the study may not necessarily be applicable to other math teachers in different districts or contexts. The findings could be subject to interpretations beyond the scope of this study. This study was a district-wide study and delimited to math teachers in one district. Therefore, this study was restricted to a relatively low number of math teachers. The scope of this study was specific to the participants and the schools at the data site. The participants included math teachers from elementary schools in a small rural school district in the north central United States of America. The study limits itself to interviewing math teachers.

Significance of the Study

No research has been conducted in the participating district at a district-wide level. Elementary math teachers and mentors participated in this study. The purpose of this study was to examine whether or not an online software program such as Skype can assist math teachers in their professional development through online support from math mentors, which support can contribute to teachers' level of self-efficacy. School and district administrators can use the findings of this study to support math teachers by developing an online professional development program in order to increase teachers' self-efficacy. Math mentors can interact with math teachers by utilizing video and voice calls, sharing of files, and sending and receiving instant messages. This study sheds further light on a much-needed area of math teachers' self-efficacy, and as a result, student achievement in math. This study generates new knowledge by specifically focusing on math teachers, thus enriching the field of math teacher research.

Literature Review

The review of literature presents information from peer-reviewed articles and research studies in the field of education. What is missing from the literature is the focus on math teachers' self-efficacy and the main factor contributing to their self-efficacy. Self-efficacy research is grounded in Bandura's (1997) social-cognitive theory. Self-efficacy has proven to be instrumental in learning and motivation (Pajares, 2008). Personal teaching efficacy has to do with one's own competence as a teacher. Self-efficacy beliefs determine how people feel, think, motivate themselves and behave. Such beliefs include cognitive, motivational, affective, and selection processes (Bandura, 1997, p. 2). Teachers' quality of performance is related to their level of motivation to influence student learning (Bandura, 1997). General teaching efficacy refers to the extent to which teachers feel capable to help students learn because teachers can influence their own efficacy by seeking out mentors and focusing on the strengths of their students. Teacher self-efficacy can be significantly increased through opportunities for ongoing discussions. Thus, teaching through support is important for teachers' sustained growth and teaching support needs to be intentional, ongoing, and systematic. Teachers' motivation is found to be the most important factor related to change in teaching practices. Professional development enables teachers to learn from their peers. The highest-achieving countries in education like Finland and Sweden have been allocating resources to support opportunities for teachers to learn from each other. Improved student achievement is what matters most. Improved teachers' self-efficacy may lead to student success. Teachers need support in thinking critically about their practices by learning from one's practices and from peers. Teachers' learning is an ongoing process. Teachers should be encouraged to reflect on their practices and to try out new approaches for achieving district and school goals by evaluating teachers' learning and measuring students' achievement. Teachers who receive substantial support could increase their students' achievement. Teachers' changes in teaching practices can improve students' standardized test scores. Teaching collaborative communities can focus on teachers' continuous improvement by tapping internal expertise of colleague teachers. The self-determination

theory (SDT) presupposes that when individuals freely choose to participate in activities, without external pressures, they are fulfilling the need for autonomy (Deci & Ryan, 1991/1985). Math teachers can show a positive gain from collaboration and interactions with fellow teachers (Alsup, 2004; Barnett, 2004; Bodovski & Farkas, 2007; Brown & Spangler, 2006; Ediger, 2008; Elmore, 2002; Fullan, 2006; Gerretson, Bosnick, & Schofield, 2008; Gilbertson, Witt, Singletary, & VanDerHeyden, 2007; Guskey, 1999/2002; Hirsh, 2004; Hirsh & Killion, 2009; Hord, 2004; Huebner, 2009; Joyce & Showers, 2002a; Laitsch, 2004; Linek et al., 2003; Lowden, 2005; Maggioli, 2004; McMillian, 2007; Miller & Glover, 2007; Mizell, 2003; Murray, Ma, & Mazur, 2009; National Staff Development Council, 2008; Peine, 2008; Reeves, 2007; Rowell, 2007; Sever & Bowgren, 2007; Sparks, 2002; Stevens, To, Harris, & Dwyer, 2008; Tchannen-Moran & Hoy, 2001; Tienken & Stonaker, 2007; Tucker et al., 2005; Viadero, 2007; Whitmore, 2005; Woolfolk Hoy, 2004; Yoon et al., 2007; Zambo & Zambo, 2008)

Research Method and Design

A qualitative case study was chosen because this inquiry was based upon (a) the respondents' feelings; (b) an in-depth analysis with a humanistic approach; (c) the review of related literature has revealed a lack of research on this topic; (d) the topic has not been investigated by qualitative means; and (e) open-ended interviews were conducted by the researcher with the participants to provide information on the increase of teachers' self-efficacy via online support through the usage of an online communication tool (e.g., Skype). A scope of particularity and complexity is embedded in a qualitative design (Stake, 1995). A qualitative design allowed the researcher latitude to investigate social trend inquiries using multiple methods that are interactive and humanistic (Creswell, 1998, 2003). However, this study was not conducted to develop a theory. This study was conducted over a six-month period and involved an in-depth data collection process and analysis. This qualitative research design afforded the researcher the opportunity to obtain a deeper inquiry per individual in order to provide as complete an understanding as possible. Math teacher self-efficacy is a factor that is best examined by qualitative means. The researcher's relationship to the math teachers was that of a researcher. The trustworthiness component was used to endorse the credibility of this case study (Lincoln & Guba, 1985). Qualitative researchers use at least two sources of trustworthiness in any given study (Creswell, 2003). The two methods utilized in this study were rich descriptions and member checking. The research question could only be thoroughly investigated through a process that promoted descriptive accounts from the math teachers and mentors as supported in a case study design.

Population and Sample

This case study was conducted at one school district. The participants were elementary math teachers and mentors. A sample of $n = 16$ teachers was purposefully selected to participate in online professional development using Skype.

Each participant received a webcam and a microphone from the school district's technical department, which assigned to each teacher a Skype account using the first name of the

teacher followed by a dot followed by the last name of the teacher. For example, if the teacher's name was Peter Kiriakidis then this teacher's Skype ID is Peter.Kiriakidis. A list of all participating teachers' Skype IDs were provided to the school and district administrators by the individual who created the accounts. The researcher examined every teacher's connectivity to the Internet and to Skype and tested communication between one teacher and other teachers within the same school building and between schools within the school district. The researcher conducted interviews with all of the participants in order to examine their self-efficacy.

Online professional development was based on interactions of math teachers with math mentors and amongst math teachers in order to share instructional expertise, ideas, and opinions for the purpose of supporting each other online. The aim of the online professional development was to provide teachers with opportunities to support each other online based on another research study that revealed that math teachers viewed *support in math* as the most contributing factor to their self-efficacy (Kiriakidis, 2010).

Data Collection

The researcher-generated interview protocol was discussed with school and district administrators and a few of the participants to ensure that the interview questions posed to the participants were appropriate and relevant. Suggested needed revisions were adopted into the protocols. Each school principal provided the researcher with a list containing the name of the math teacher, the classroom number, and teaching period. The math teachers were asked the interview questions according to the interview guide. For example, the researcher asked participants to explain (a) how self-efficacy was an important factor for their performance as math teachers; (b) how Skype as an online communication tool contributes to their level of self-efficacy; (c) how online professional development contributes to the increase of their self-efficacy; (d) how online support may increase students' performance in state math testing; and (e) how supporting math teachers through Skype's features such as video and voice calls, sharing of files, and sending and receiving instant messages can sustained professional growth.

The open-ended interviews were conducted by the researcher with the math teachers in the classroom where the teachers teach math lessons and each interview lasted a teaching period. Each participant provided data on the aforementioned interview questions, shared their personal feelings of teaching math, and reflected on their personal feelings of self-efficacy. Math teachers answered open-ended questions that took on a perceptual or personal view of the participant's self-efficacy. The researcher sought insight into the factors that affected the participants' feelings of self-efficacy. These factors included collaboration with other math teachers and mentors, and school and district administrators with regards to the usage of Skype in their classrooms with a webcam and microphone to communicate with other math teachers and math mentors (i.e., video and voice calls, sharing of files, and sending and receiving instant messages).

Data Analysis

After transcribing the interviews, case analyses were conducted by the researcher for each math teacher. The data analysis process deepened as information about each math teacher's usage of video and voice calls, sharing of files, and sending and receiving instant messages and how such usage of Skype's features affected their self-efficacy. The data from this analysis were used to answer the research question that guided this study. During the reviewing of the transcripts, the researcher thoroughly examined how the online features of Skype contributed to the participants' reported level of self-efficacy. The data were categorized and recorded in color-coded notebooks that represented personal feelings and each teacher's instructional practices, preparedness, creativity, personal feelings of self-efficacy, and performance level based on the features of Skype they used (e.g., video and voice calls, sharing of files, and sending and receiving instant messages).

During the data analysis process several themes were common to the participants during the reading and deciphering of the interview transcripts. For triangulation purposes, the data from the interviews were cross-checked. The researcher found that the codes revealed in the participants' interview responses and observations by the researcher were consistent. Once the data were thoroughly collected, organized, examined, and analyzed, the data revealed several themes that represented an underlying concept (Merriam et al., 2002). Themes were then examined based on their conceptual similarities to the study (Creswell, 1998). The researcher examined the themes and conducted a thematic analysis.

Researcher Bias

The two methods utilized in this study were descriptions and member checking that contributed to the researcher's ability to aid the reader in determining whether or not the findings can be transferred (Creswell, 2003). Member checking contributed to the credibility of the findings in this study by minimizing investigative bias (Stake, 1995). Understanding of the participants' data by the researcher was presented to the participants for their feedback. This process ensured that the responses understood by the researcher were indeed the participants' true feelings, expressions, thoughts, and ideas (Creswell, 2003).

Participants' Rights

Permission to conduct research in all of the schools in the participating district was obtained. The math teachers in the district received information about this research via their school administrators who received guidelines via the district administrators. Following the district's guidelines, the participants' rights were safeguarded. The names of the participants and the name of the district were not used in any reports or presentations. The raw data will be held by the researcher for 5 years, after which time all data will be destroyed. Data are available to the participants and district stakeholders upon request.

The Findings

All participants reported a high sense of efficacy in teaching math. Math teachers viewed online support in math as a contributing factor to their self-efficacy. Specifically, teachers reported that the more online support they receive from other math teachers and mentors the more their self-efficacy levels increased. Teachers also reported that the higher their self-efficacy levels the more likely their students will perform better in state math testing. Specifically, teachers' self-efficacy can be influenced through teacher-to-teacher online interaction because interactions with other math teachers serve as a form of self-development and adaptation as stated in Bandura's social-cognitive theory. The importance of developing and supporting efficacy of math teachers is an important conclusion. Teachers' online interactions must remain high priorities at the school district because teachers' interactions to support each other is an important factor that relates to effective communication, to building professional learning communities, and to assist students in learning math concepts.

One teacher reported she received online support by other math teachers, and as a result she improved her teaching strategies. Another teacher reported that the online teacher-to-teacher interaction was an excellent mentoring experience. Another teacher reported that online support provided by other teachers within the school and school district improved staff morale. Another teacher reported that online support created better teamwork. Another teacher reported that district-wide facilitated online interactions amongst math teachers and mentors helped teachers share instructional ideas, lesson plans, and expertise. Another teacher reported that online support was needed for the betterment of her teaching strategies. Another teacher reported that online support helped her feel more confident teaching math as her instructional practices have improved. Most participants reported that they need to have ongoing online interactions with colleagues to share resources, ideas, expertise, and teaching strategies. Most participants reported that online support will help their students do better academically; however, administrative support is necessary in order to increase their self-efficacy.

Commonalities and Differences Among The Cases

Major themes were identified. Specifically, math teachers need online support with professional development. Teacher online support in math is a contributing factor to teachers' self-efficacy. Teacher online support in math serves as a form of self-development and adaptation. Teachers' online interactions relate to effective communication, to building professional learning communities, and to assist students in learning math concepts.

Discussions and Conclusion

The importance of developing and supporting efficacy of math teachers through online support is an important conclusion. Math teachers reported that online interactions with other math teachers is related to their self-efficacy, which serves as a form of self-development and adaptation. These findings are in line with those reported by scholars in

the field of teaching and learning. Teachers need assistance in mathematical pedagogies (Beswick, Swabey, & Andrew, 2008) and mentoring (Cordingley, 2005; Killion & Harrison, 2006) to increase student achievement (Bransfield, Holt, & Nastasi, 2007). School and district administrators should support math teachers with coaching (Jonker, 2008) by other math teachers to help teachers in improving instructional practices and standardized test scores (Beecher & Sweeney, 2008). Support is required (Nelson & Slavitt, 2008) to advocate and facilitate teacher-led assistance for math teachers to maintain student interest and maximize student engagement (Fulk, 2000; Fullan, 2000). Math interventions improve academic achievement of students (Gilbertson, et al., 2007) and instructional practices can be improved when teachers receive support for change in instructional practices (Sadler & Sugai, 2009). Math teachers mentored by highly trained and proficient mathematics teachers continuously improved their instructional practices (Miller & Glover, 2007) by creating collaborative communities that focus on the capacity for continuous improvement (Fullan, 2006).

Recommendations

District administrators should (a) seek support from the local educational institutions to support math teachers at each school during school hours; (b) create and maintain partnerships with community organizations to help math teachers; with input from math teachers, support math teachers' efforts with in-service, training, and professional development opportunities.

Implications for School and District Change

Implications for change include an understanding not only of the challenges faced by math teachers but also how those challenges can be addressed. Additional improvements include increased options for online professional development, specifically designed for teaching math.

Parents benefit from highly qualified teachers who understand and use pedagogically appropriate strategies to teach their children. School districts and the community benefit from having high quality math teachers. Math teaching goes beyond K-12 and extends to adult education programs.

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