ROLE OF MATHEMATICS TEACHER IN USING TECHNOLOGY

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Abstract: Investigating the effect technology has on the secondary mathematics classroom instruction has been a growing topic in mathematics education since calculators and computers became readily available to students and teachers. Most of the focus has been on students' use of technology to enhance their mathematical knowledge, while teacher use of technology during instruction has had limited research attention. The purpose of this study was to further understand the emergence of the roles of facilitator and mediator when secondary mathematics teachers used technology during instruction.

Conceptual and procedural mathematical activities affected the participants' role while teaching with technology. An emergent theme of the source of mathematical activities, internal or external, helped illuminate the development of teacher roles while using technology. Procedural mathematical activities were found to only contain external sources of mathematical activities while conceptual mathematical activities contained both internal and external sources. A connection was established while comparing the source of mathematical activities with the teachers' roles while using technology. The analysis indicated that the facilitator role was only observed when teachers' had conceptual mathematical activities that involved internal sources. When an external source was observed, the teachers' role was found to be that of a mediator.

Keywords:in service mathematics teachers, technology, teacher roles, mathematical activities, sources of mathematical activities.

Introduction: Mathematics teaching practices have been changing for the last few decades. Research shows that teachers are stepping away from the chalkboard or whiteboard and stepping into the realm of calculators, computers, and interactive whiteboards. Even with all of the changes in the instructional practices that mathematics teachers make with technology, little attention has been given to the role teachers take on when using the technology and the curriculum they teach. A standards based curriculum can be found in some schools, but the traditional computational based curriculum still dominates. The task of implementing the technological resources and the roles while using technology in a procedural curriculum is left up to the teacher. Teachers' judgment for the implementation of technology into their teaching practice then rests on their knowledge of technology, knowledge of mathematics, and knowledge of teaching[1,2,].

Mathematical Activities: In many instances, it can be said that a single mathematical lesson can be composed of one or more mathematical activities. The tools and mathematical activity construct proposed to technology uses in different types of mathematical activities. This construct relates ways cognitive tools can provide special opportunities or impediments to learning in the context of a mathematical activity. A technical mathematical activity is described as performing procedures. Using technology is many times referred to as technical regardless of how it is used. To avoid any confusion for the reader, I will refer to technical activities as procedural activities. A conceptual mathematical activity involves depth of knowledge and understanding. This dimension can be observed though the use of reasoning and mathematical connections. The definition of a mathematical activity used in the present study differs from that of Hand, a mathematical activity through the discourse of mathematics as students interact with it. This description may be an interesting way to view a mathematical activity, but my focus is on mathematics teachers' interaction with mathematics [5]. The definition of a mathematical activity puts the main focus on the interaction the teacher rather than the student has with the mathematical activities [12].

Research Questions:A teacher's knowledge of technology and how to use it is essential to using it both appropriately and effectively in a secondary school mathematics classroom. I believe that more emphasis is needed on the mathematical activities as it promotes the use of technology. Mathematics education researchers need to look at how teachers

from technologically rich mathematics education programs are addressing the curriculum they teach through the roles they take on when using modern technological tools. Research questions guided the study are (a) How are mathematical activities developed by secondary mathematics teachers from a technologically rich mathematics education program categorized when they use technology? (b) What roles, mediator or facilitator, do teachers from a technology rich mathematics education program take when the use of technology is observed? (c) How do these roles fit into different mathematical activities?

Technology Use In Mathematics Education Research: "Appropriate uses of technology tools can enhance mathematics learning and teachings, support conceptual development of mathematics, enable mathematics investigations by students and teachers, and influence what mathematics is taught and learned". These studies found that technology had mixed results in the area of student understanding. Reports by other researchers' shows that different avenues need to be explored and developed in order to draw conclusions about students understanding when technology is used. Rather than examine technology use versus no technology use, there is a need to examine mathematics teachers' use of technology [3, 4, 10, 11].Many challenges mathematics teachers would face as an immediate consequence of technology. These challenges included: difficulty for the average teacher to implement computers into a typical classroom on a regular basis, pressure through the curriculum toward easy measurable skills, limited experience and training in the use of technology in a classroom setting, and little if any technological support for their daily work. All of these challenges exist today and will continue. A strategy for analysis describes roles of new technologies in the mathematics classrooms and how they affect each content area [6]. Even though this was a good recommendation for investigating the effect of technology, it would be an enormous task and almost impossible to keep updated with new technologies.

Mathematics Teacher Roles: A teacher plays an active role in students learning through social interactions between teacher and students. Mediators are seen to fit in a social constructivist paradigm. The role of a teacher in a radical constructivist paradigm is that of a facilitator. Teachers who lead discussions between themselves and students with a computer display as the focus are described as facilitators.

The teachers assumed the role of consultant, fellow investigator, and resource more often when using technology. Farrell concluded that teachers were holding on to their roles as manager and task setter while taking on new roles of consultant and fellow investigator when technology was used. When students were using technology, they worked together more often than when technology was not used. The students assumed the roles of task setter and consultant more often when technology was in use. The roles of manager and fellow investigator were not observed during lessons without the use of technology, but were observed a small percent of the time when technology was in use.

Mathematical Activities and Teacher Roles Framework: Employing the teacher roles when using technology in a mathematical activity framework enabled the present study to deeply examine the teacher's role and also the effects the mathematical activities had on the teacher's role. A teacher's role in the classroom has the possibility of affecting how students will use technology and learn through the use of such technology.

This mathematical activity fit into the category of a conceptual activity. The emphasis is on understanding the mathematical connections between division of powers and subtraction of their exponents as well as the connection between the quotient property and negative exponents. This activity used multiple representations when solving a problem involving the quotient of powers in order to show the relationship between powers with negative exponents and powers of a fraction. The smart board was used to emphasize this connection. The smart board's software enabled Bill to go back to previous slides that involved the division of powers to show how negative exponents and powers of a fraction can be created.

This mathematical activity was a conceptual activity. It was used to build understanding through the use of mathematical connections and relationships. Bill was able to connect the concept of a zero exponent to the quotient property in order to define the zero power property. This activity also used multiple representations to further the relationship between the quotient property and the zero power property. In this case, the definition was not given to the students; it was realized through mathematical connections.

Teacher's Role When Using Technology: This mathematical activity was a procedural activity. The mathematics needed to find roots was presented using the smart board as computational. Revealing parts of the smart board page to answer the question of why began to show connections between roots and exponents, but the page was designed to show this relationship through computations. The definition was classified as a type of algebraic manipulation. This mathematical activity had aspects that were both procedural and conceptual. Overall this activity was classified as conceptual.

For teachers from a technological rich mathematics education program the sources of mathematical activities had a direct impact on the role that they took on while teaching with technology. Mathematics teachers will not relinquish other roles and move to become facilitators. Simply giving mathematics teachers technology to teach with, even mathematics teachers who have knowledge of the use of technology, will not insure that they move to become facilitators. The role of a facilitator is a complex one, with the source of the mathematical activity and type of mathematical activity influencing a teachers' role when using technology much more than the access to the technology [8].

In the present study, mathematical activities and teacher roles while using technology did not have the connections that I had expected. Nonetheless, my search for a connection between the two contributed to the emergence of internal and external sources of mathematical activities. The topic of instructional strategies did appear in the pre-interview protocol, but because of my preconception that there were connections between the mathematics activities and the teacher roles, the significance of the strategies was minimal. My initial focus on the use of technology in the secondary mathematics classroom prevented my undertaking more detailed research on internal and external sources of the mathematical activities.

Conclusions: There is a great need for longitudinal studies of teachers who use technology in their classroom, especially those with teachers who have similar knowledge of the use of technology. Follow-up studies of emerging themes concerning mathematical activities and sources of mathematical activities could provide greater understanding of the development of roles and may provide insight into role progression and role change.

Additional research into internal and external sources of mathematical activities might extend the perspective that emerged from the present study and provide more insights into the development of teacher roles with the use of technology. Deeper research on internal and external sources of mathematical activities as they pertain to the integration of technology might bring further understanding into the development of teacher roles. Such research might increase the understanding of how and why different sources of mathematical activities impact teacher roles. It might also shed light into how knowledge of technology and knowledge of mathematics affect the development of teacher roles.

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