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Orienting to the phenomenon of teachable moments through teachers' lived experiences

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The paper draws from a hermeneutic phenomenological research study, which aims to explore mathematics teachers' lived experiences of teachable moments. Building on a previously published CERME article that focused on the personal lived experience of teachable moments through storytelling in mathematics teaching, this paper presents the results of the next stage of the research, which centers on the lived experiences of mathematics teachers. Specifically, the paper presents the lived experience of one of the teachers participating in the study through a crafted story derived from the interviews. The story reveals what it is like for teachers to experience teachable moments and how moment-to-moment teaching of mathematics is a complex balancing act between knowledge, emotions, and actions.

Keywords: *Knowing to act, teachable moment, hermeneutic phenomenology.*

Introduction

This paper draws from a hermeneutic phenomenological research study that aims at exploring the mathematics teachers' lived experiences of teachable moments. The research derives much inspiration from Max van Manen's (1991) insightful appraisal of *The Tact of Teaching*:

In all of our interaction with children, we are constantly involved, whether we like it or not, in distinguishing between what is good and what is not good for them (in contrast, educational research is usually more interested in distinguishing between what is effective and what is ineffective). Yet even (or especially) the best educators temper their practice with the knowledge that we all often fall short and do not know what is best. (p. xii)

Research in mathematics education lacks consensus on what makes teaching effective or ineffective. Scholars focus on teacher knowledge and emotions, such as content knowledge, pedagogical knowledge, curriculum knowledge, knowledge of students, mathematical self-efficacy, math anxiety, and attitudes (Foote et al., 2011; Muri, 2008). Some researchers explore integrating mathematics and teaching knowledge, as in Shulman's (1986) pedagogical content knowledge, and Ball and Bass's (2000) mathematics knowledge for teaching. However, these factors alone do not fully explain effective or ineffective teaching. Researchers also examine teacher emotions and their impact on teaching and learning (Burton, 2004; Zan et al., 2006). Affect in mathematics education investigates the role of emotions in mathematical thinking and learning within social contexts. Emotion can offer insight into individual teaching experiences but does not fully capture moment-to-moment teaching decisions (van Manen, 1991). A humanistic approach, as proposed by Doxiadis (2003), suggests effective mathematics teaching involves humanizing the subject for learners, considering their narratives and experiences. This transcends content delivery and skill development, focusing on understanding students as individuals (Chapman, 2008). Humanistic mathematics can involve

storytelling and interdisciplinary connections (Tennant, 2002). Cernajeva (2012) and Doxiadis (2003) emphasize the need for incorporating learners' perspectives and providing opportunities for in-depth thinking. This approach aligns with Mason's (2002, 2015) concept of awareness, which combines emotion and knowledge to act in the moment.

Although researchers agree on the importance of teachers' knowledge and the role that teachers' emotions play, in both mathematics learning and teaching, there is little consensus about what contributes to being an effective/ineffective mathematics teacher. In their discussion of numeracy teachers, Askew et al. (1997) note that teachers' knowledge together with their implicit beliefs or theories influence their interpretation of classroom events—in other words, their ability to notice and take up these teachable moments—which Mason (2015) refers to as knowledge available in the moment for a teacher. Clarke et al. (2002) found that effective mathematics teachers use such moments, whether unexpected or expected, to create connections to previously taught mathematical ideas and experiences. Muri (2008) notes that a teachable moment is a “teacher’s simultaneous act in response to a student’s answer, comment or suggestion and is utilized to either address a possible misconception or to enhance conceptual understanding” (p. 362). According to Mason (2015), becoming aware of teachable moments (which he refers to as unexpected things) represents an awakening that sharpens individuals’ attention, enriches noticing, opens up fresh possibilities of action, and also enhances individuals’ ability to respond to similar situations in the future. In discussing such automated, habitual actions, Mason (2015) observes that “what matters even more than noticing an opportunity is how that opportunity is taken up, how the released energy is used” (p. 110)—in other words, how teachable moments are noticed and taken up, which is the focus of our research. Given the importance of teachable moments in mathematics teaching, our study and this paper focuses on the mathematics teachers’ lived experiences of teachable moments.

Formulating the research questions

Mason (2002) observes that transforming professional practice into a focused research study first entails convincing others of what one has discovered. Keeping this in mind and van Manen’s (1991) suggestion for researchers to begin with a personal story, this research began with the first author’s stories which focused on teachable moments through storytelling in mathematics teaching. (Toor & Mgombelo, 2015). In her process of wanting to make math meaningful for her students, the author decided to teach by telling and creating math stories in her math class. Sharing mathematical experiences through storytelling gave the classes a new tone, and made mathematics come alive. Students enjoyed glimpsing the human side of their teacher as well. Although not all the class sessions were about storytelling the author noticed that humanizing mathematics through storytelling impacted class discussion. It provided an opening that inspired reciprocity and helped create an atmosphere in which students were more willing to share their ideas. For the author as a teacher, she sought to create teachable moments as they are the most cherished prize of teaching. Still, though she may have noticed the teachable moments, she often struggled with what to do with these moments. She began to wonder about teachable moments in mathematics teaching, what to do with them and how other teachers notice and take-up teachable moments, and what those moments looked like to them.

Purpose and research questions

To investigate the notion of teachable moments, one needs to orient themselves to the question of meaning of teachable moments, which in turn can be derived from the experience of teachable moments: “We need to search everywhere in the lifeworld for lived experience material that, that upon reflective examination, might yield something of its fundamental nature” (van Manen, 1991, p. 53). Max van Manen offers several approaches to gathering or collecting lived experience materials of different forms, such as personal experiences, interviews, observations, and fictional texts. This research focuses on personal experience of teaching mathematics as a lived experience that materializes from reflection on teachable moments. In this sense, the research study seeks to explore mathematics teachers’ lived experiences of teachable moments. For this research, we define the term *teachable moment* as an opportunity that arises when a connection has been made to advance learning, recognize learning, and/or recognize the gap in learning by a learner and/or a teacher. More specifically, the term *moment* is distinctly defined as an expected or unexpected occurrence that allows learners and/or teachers to deepen their understanding of when such a connection is made. The main guiding question for the research is: What are the lived experiences of K–12 teachers in their moment to moment teaching of mathematics? Specifically, the study addresses the following sub-questions: What is it like for K–12 teachers teaching mathematics to experiences teachable moments? How is it like for these teachers to notice teachable moments? In what ways are the teachable moments taken up by these teachers?

Methods

The question: What are the lived experiences of K–12 teachers in their moment to moment teaching of mathematics, is a highly subjective phenomenon. This calls for a hermeneutic phenomenological research design. Phenomenological research describes a “lived experience” of a phenomenon. Phenomenology becomes hermeneutical when its method is taken as interpretive manner compared to descriptive as in other forms of phenomenology such as transcendental phenomenology (van Manen, 1990)

The participants for this study include six grade K–12 teachers (kindergarten 5–6 years old to grade 12, 17–18 years old) with experience of teaching mathematics, ranging from beginner, mid-career teachers, and teachers nearing the end of their career or teachers who have retired from teaching, to ensure balance. The data was collected using a semi structured interview. Data in this sense was collected from the personal stories of the K–12 teachers with experiences of teaching mathematics, which teachers will tell by answering interview questions. The interview questions emerged from literature review as well as through the first author’s reflection on the experiences of teaching and collecting her personal stories related to the phenomenon of teachable moments. Participants were asked to recall from their teaching experiences a particular moment or moments when they noticed something unexpected or a surprise. They were asked to describe the details of that moment as they experienced it. Also, they were prompted to try not to speculate, imagine or guess; to just stick to their personal experiences; to just tell it as they experienced it. In other words, to just describe it as it happened or as they lived through it. Interviews were recorded and transcribed. In hermeneutic phenomenological sense, the lived experiences of participants are presented into two types of stories.

First, there are participants' stories, which are the stories they tell by answering interview questions which are presented in the transcripts. Second, there are stories crafted from the transcripts by the researcher after delving into participants' stories to understand the phenomenon. Next the researcher reflect/interpret the crafted stories to bring forth the themes which help in understanding of the phenomenon of teachable moments and help shed light on the research questions.

Findings

Keeping in mind Mason (2002) observation that transforming professional practice into a focused research study first entails convincing others of what one has discovered and van Manen's (1991) suggestion for hermeneutic phenomenological researchers to begin with a personal story, in (Toor & Mgombelo, 2015), we presented the first author's stories and the results of this initial stage, of the research, focusing on the author's experiences of storytelling in a grade 6 to 8 mathematics classes for the purpose of humanizing mathematics as a way of engaging both the 'being' of mathematics students and their cognitive faculties. In this paper we now present part of the results of the second stage of the research involving other teachers. We present the story of one of the participants, Ms. Adam (pseudonym) and our hermeneutic reflections on her story to reveal the phenomenon of teachable moments.

About Ms. Adam

Ms. Adam is a Grade 6 teacher, who has been teaching for 5 years. She decided to become a mathematics teacher because she believes there is a different way to teach math, rather than just having students memorizing formulas (which was her experience of learning math). Ms. Adam believes that math should be taught in a way that explains things in such a manner that students understand the concept. She states: "I want them to see there are multiple ways to get to an answer. It's not just my way, it's your way as well. It's how you come to it. So, it's just showing them that flexibility, that there's so many things you can notice and that just be open to it". She believes that her role as a math teacher is not only to teach math concepts but also impact positively students' attitudes toward mathematics.

Recalling the moment: Ms. Adam's story

When I was doing the tutoring for the grade sixes and sevens after school. I was looking at how to convert percentages to fractions to decimals. I remember trying to show students an example on the board. I was trying to get them to tell me, how are percentages, fractions and decimals related. I realized that the grade sixes, some of them, are looking at these three, and they don't see that they are related. First off, they think they are separate things. So, for me, I am thinking, what do they mean they are separate? Everything in math is related. What do they mean that percent, fractions and decimals are separate? And so, for me, I'm just thinking, what do they mean its separate? It's not separate.

So, I thought, it is about just getting them to see, what it is this? How to say it? And I will show them the fraction. I remember I had something like fourteen over a hundred ($14 / 100$). And then they said it. They said fourteen over a hundred. I said, "OK, can you show me that as a decimal?" And they are like, No, that's a fraction. I realized that these kids obviously do not see that the three are connected.

That's one thing. And then I also realized that maybe their place value knowledge is not where it is supposed to be. So, in my head, it was like in that moment, things are clicking for me as it is happening and I am realizing, wait, there's a gap here. Wait, there is something. And it is just happening automatically. I can't even describe it to you. It is like almost as automatic. It is like my brain is on autopilot and I am not really thinking about my next question. It is just this is happening, this is happening now and my brain is just saying do this.

Next thing that I asked, "can you tell me what place these numbers are in, on the place value chart?" so we started going through it like that. We looked at the decimal part of the number and I realized they don't know their tenths, and hundredths. The way they said it was ones, tens, hundreds. They thought it was a whole number side. It is like, no, this is a decimal number. You can't say it like that. And really what we got out of that lesson was one, percentages, fractions and decimals are all connected. Two, if you learn how to say a fraction properly or you learn how to say a decimal the right way, like 58 hundredths, you can now write it as a fraction as 58 hundredths ($58 / 100$), and so when that started clicking, then they are like oh! They started seeing the relation and they actually started seeing the place values. A big part of it.

But there were gaps that I was seeing that needed to be filled. To me, when I think about a teachable moment, how do we define it? Is it basically just a moment in time where there is an opportunity to change the thinking or is it that a kid made a mistake and now we are trying to fix it? Is it not possible to go back and still be as effective in fixing this moment? To me, the answer is you can go back. As teachers, we work with these kids six hours a day. We have conversations with them all the time. I don't see why we can't go back. So, if I miss a moment. I do go back, and I talk to those kids. I began my recalling with them, like, you know, yesterday remember, we were talking about this and that. And I noticed this. And then that is when I tried to fix the moment.

Hermeneutic phenomenological reflection on Ms. Adam's story

Ms. Adam's story offers a glimpse into the lived experience and the dynamic nature of teachable moments in the math classroom. In this story, Ms. Adam experiences a teachable moment as she recognizes gaps in her students' understanding of mathematical concepts. We can interpret her moment as a rich and multilayered experience that involves both cognitive and emotional elements. As Ms. Adam guides her students through the relationship between percentages, fractions, and decimals, she realizes that "some of them, they're looking at these three, and they don't see that they're related." This recognition of a gap in her students' understanding triggers a teachable moment. From Ms. Adam's story we can identify several layers of her lived experiences in her moment-to-moment teaching of mathematics. Her story reveals her thought process as she navigates through teachable moments and the ways she adapts to gaps in her students' understanding. From Ms. Adam's story we see that her lived experiences of her moment-to-moment teaching of mathematics has three themes. First, there is recognizing the gaps in students' understanding. Ms. Adam describes a moment when she realizes that her students see percentages, fractions, and decimals as separate entities: "First off, they think they're separate things. So for me, I am thinking, what do they mean they are separate? Everything in math is related what do they mean that percent, fractions and decimals are separate?" In this sense, she mentions, "in that moment, things are clicking for me

as it's happening and I'm realizing, wait, there's a gap here." This demonstrates her ability to dynamically assess the situation, identify gaps in understanding, and make adjustments on the fly. Second theme of her moment to moment lived experience entails, adapting to students' needs in the moment. Ms. Adam experiences a fluid, almost automatic process of identifying and addressing her students' misconceptions: "It's like my brain is on autopilot and I'm not really thinking about my next question. It's just this is happening, this is happening now and my brain just saying do this." The third theme of her moment to moment lived experience is about reflecting on teachable moments. Ms. Adam ponders the nature of teachable moments and considers the missed opportunities: "So I think there are missed opportunities that you don't even get to go back to because you didn't think of it." For Ms. Adam, experiencing teachable moments involves a dynamic process of recognizing gaps in understanding, adapting her teaching approach in real-time, and reflecting on the nature of such moments.

For Ms. Adam, experiencing teachable moments is both an intuitive and reflective process. She describes her brain as being "on autopilot" and not consciously thinking about the next question. The teachable moments emerge organically, and Ms. Adam is quick to recognize and capitalize on them. She states, "It's just this is happening, this is happening now and my brain just saying do this." Noticing teachable moments for Ms. Adam appears to be an intuitive process. She is attuned to the needs of her students and quickly identifies when they struggle with a concept: "I realized that these kids obviously not seeing that three are connected. That's one thing. And then I also realized that maybe their place value knowledge is not where it's supposed to be."

Discussion and conclusion

The purpose of hermeneutic phenomenological reflection is to try to grasp the meaning of a phenomenon under study. To come to terms with the meaning of the phenomenon like teachable moments a hermeneutic phenomenological researcher must engage in a reflective activity and think of the phenomenon described in terms of structures of meaning, meaning units or themes (Van Manen, 1997). The well-crafted phenomenological story can reveal ways of being, thinking, and acting in the world that shed light on what is known but covered over, or forgotten. Stories crafted in hermeneutic phenomenology are thus a provocative and powerful means of evoking shared pathic responses (van Manen, 2014). They can communicate the way we humans make sense of events and relationships, both with ourselves and with others. In a story, we encounter ourselves in dialogue and experience ourselves in different ways. As Gadamer (1976) explains, we are at once interpreting and making the story our own; understanding a story is to 'always and already' to understand and recognize ourselves within it. Ms. Adam's story reveals what it is like for her to experience a teachable moment. The story shows that for her the teachable moment happens in her moment-to-moment interaction and working with her students around mathematics concepts in this case, about fractions, percentages and decimals. We see that it was in that moment in her interaction with her students that she realized that students did not understand mathematics and that there was a gap in students' knowledge that prevented their understanding of the concepts. The story reveals the nature of a teachable moment, the way it happens as a fleeting moment and yet with a burst of emotions, and energy something as we see in Ms. Adam's story.

Even though the teachable moment happens quickly, for Ms. Adam the teachable moment reveals to her an awareness that calls for action, the knowing to act in the moment as Mason alludes (2015). She notes “It is just this is happening; this is happening now, and my brain is just saying do this.” Finally, Ms. Adam’s story reveals that even though the teachable moment happens in a fleeting way and in action, it is not just something that can just be acknowledged and left as is. For Ms. Adam teachable moments need to be taken up revisited with students.

The “teachable moments” are viewed as a somewhat intangible pedagogical prize; a teacher might know what it feels like yet may not identify its characteristics. Educators such as mathematics teachers seek moments of openness and creativity with their students so they can personally experience “the psychic rewards” of teaching (Lortie, 1975). Too often, such moments happen suddenly and slip away just as quickly, leading some teachers to conclude that such occurrences are a matter of chance. This paper therefore seeks to shed some light on the teachers’ lived experiences of teachable moments in mathematics education to deepen our understanding of teachable moments and how teachers might use them in their practices. By focusing on the lived experiences of mathematics teachers, this paper and the study will contribute to mathematics education research on a specific element of teaching (i.e., teachable moments) that prior studies have not thoroughly addressed. Teaching is a complex phenomenon encompassing ever-changing situations and teachers who are constantly challenged and called upon to positively deal with unanticipated and unexpected circumstances. The paper and study highlight the ways in which teachers make meaning of their lived experiences of teachable moments, which in turn can inform teachers and teacher educators alike about what teachable moments are and what it means to teach mathematics in a moment-to-moment basis.

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