PRE-SERVICE AND FIRST-YEAR TEACHERS' VIEWS ON THE INFLUENCE OF MATHEMATICS METHODS TEXTBOOKS

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We investigated how pre-service and first-year teachers engaged with the pedagogy textbooks from their mathematics methods courses. Sixteen participants – seven pre-service teachers and nine first-year teachers – were interviewed about their interactions with mathematics methods texts and their perceptions about the texts. This paper focuses on participants' views regarding the messages sent by their mathematics methods textbooks about how to teach. Findings describe the tensions that exist between pedagogy textbooks and participants' experiences in the classroom. Implications for teacher educators are also discussed.

Keywords: Teacher Education-Preservice, Affect, Emotion, Beliefs, and Attitudes, Teacher Beliefs

How do prospective teachers interact with mathematics methods textbooks and how do these interactions shape prospective teachers' views of teaching? As Mesa and Griffiths (2012) noted, "textbooks remain a ubiquitous course component with various implications for the teaching and learning of mathematics at a tertiary level" (p. 86). We suggest that implications also exist for the use of textbooks in the teaching and learning of mathematics education in higher education settings. Yet, there is a lack of research that examines ways in which prospective teachers interact with mathematics pedagogy textbooks. Although there are numerous studies that have looked at the relationships between teachers, learners, and mathematics textbooks in K-12 education (Freeman & Porter, 1989; Haggarty & Pepin, 2002; Herbel-Eisenmann, 2007; Herbel-Eisenmann, 2009; Mesa, 2004; Remillard, 2000), few studies have examined these relationships in higher education settings. Moreover, the focus of studies conducted at the tertiary level have centered on textbook use in content courses, not pedagogy courses (Lithner, 2003; McCrory & Stylianides, 2014; Mesa & Griffiths, 2012; Weinberg & Wiesner, 2011; Weinberg, Wiesner, Benesh, & Boester, 2012). We posit that textbooks are an important component in mathematics methods courses for prospective teachers and the ways in which prospective teachers engage with these texts should be explored. In this paper, we discuss findings from interviews with pre-service and first-year teachers regarding the messages sent by their mathematics methods textbooks about how to teach.

Background and Theoretical Framework

While textbooks play a role in many mathematics methods courses, there are some issues of power that need to be addressed. Several textbook studies address the authoritative nature of textbooks and of the ways in which instructors mediate textbook use (Haggarty & Pepin, 2002; Herbel-Eisenmann, 2007; Herbel-Eisenmann, 2009; Mesa & Griffiths, 2012; Smitherman, 2006; Weinberg & Wiesner, 2011). The authoritative nature of textbooks can create tensions between the messages conveyed in texts and the ideologies of the mathematics education community. Herbel-Eisenmann (2007) investigated the "voice" of a Grade 7 textbook to see if it reflected the ideology emphasized by the *Principles and Standards of School Mathematics* (National Council of Teachers of Mathematics [NCTM], 2000). By using a discourse analytic framework to examine different linguistic features of the textbook, Herbel-Eisenmann found that the human agency in mathematics was often masked through the absence of different pronouns and the presence of modal verbs (i.e., could, might, would). Yet, many mathematics educators and the *Principles and Standards of School Mathematics* (NCTM, 2000) advocate for human agency through "doing mathematics" as one learns.

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Tensions also existed with how "the text represented a strongly certain viewpoint of mathematics. This viewpoint is absolutist or Platonist in nature rather than fallible" (Herbel-Eisenmann, 2007, p. 362). This absolutist view can also be seen in pedagogy textbooks. In Smitherman's (2006) analysis of ten different mathematics education pedagogy textbooks, all but one of these textbooks "exhibit modern, rationalist, ideas in mathematics education" (p. 61). For Smitherman, this meant the pre-service teachers' expectations of what it meant to teach were shaped by notions of mathematical proof which were evident in the textbooks: replication is possible; mathematics education is comprised of a universal language; and it is based on a predictable cause-effect relationship. While aspects of these notions are indeed present with mathematics education, they also do not fully take human presence into account. For example, if predictable cause-effect relationships were possible in the classroom, then one could assume that several ideas from students "doing mathematics" would be dismissed as not fitting the prescribed relationship that is predicted and replicated.

Furthermore, Smitherman's (2006) analysis found that "the conversations in these texts [were] one-sided and unilateral" (pp. 63-64). For example, when these textbooks defined mathematics, the opinions and ideas held by the prospective teachers were never acknowledged in any of the textbooks. This emphasized the authoritative nature of the textbooks, in which "the authors of these texts [were] trying to create a particular way of conceiving math" (p. 65). We posit that this also creates an ideological tension with the mathematics learning emphasized in methods courses.

Weinberg and Wiesner (2011) also described conflict created by a textbook's authoritative nature as they applied reader-orientated theory to calculus textbooks. There are three types of readers central to reader-oriented theory: the intended reader (the image of the reader the author has), the implied reader (the qualities needed to read the text in the way the author intended), and the empirical reader (the actual reader). "The authority inherent in school textbooks adds to the tensions between the three readers" (Weinberg & Wiesner, 2011, p. 57). As explained by Weinberg and Wiesner, textbook authors typically envisage readers that employ active reading strategies (implied readers) and readers that are part of the mathematics community (intended readers). This creates a tension with the authoritative nature of textbooks that conveys a specific "truth" of mathematics to empirical readers. Weinberg and Wiesner also posited that if the intended, implied, and empirical "readers are not in alignment, the student will not be able to generate the appropriate mathematical meaning through reading the textbook" (p. 57).

Yet, the relationship between the text and the reader is often mediated through course instructors. However, if there are tensions with the authoritative nature of textbooks, then there are also tensions that exist with the authoritative nature of instructors using those textbooks. Mesa and Griffiths (2012) saw a difference in how instructors used textbooks with students depending on if instructors classified students as "undergrad students" (e.g., students in their first years of tertiary education taking courses to fulfill requirements or students taking remedial courses) or as "math students" (e.g., honors students or those students in upper division or graduate mathematics courses). Mesa and Griffiths posited that "although instructors may want students to read the textbook, or do something more with it than doing the homework or reading the examples, they seem to describe this expectation as reasonable for students in upper division courses, but not for students in lower division courses" (p. 97). This stance is confronting when combined with the role of teachers as mediators of the text as discussed by Haggarty and Pepin (2002). Textbooks have a large influence in the classroom, and teachers control the ways in which the textbooks are used. As Haggarty and Pepin suggested:

> [teachers] decide which textbook to use; when and where the textbook is to be used; which sections of the textbook to use; the sequencing of topics in the textbook; the ways in which pupils

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engage with the text; the level and type of teacher intervention between pupil and text; and so on. (p. 572)

Thus, instructors can choose to use a text differently depending on how they classify students, and as Mesa and Griffiths (2012) contended, a "direct consequence of the different schemes that instructors have for using the textbook…results in different opportunities for these students to learn" (p.101).

Methodology

In order to garner multiple perspectives, we sought out participants who would be or were teaching various grade levels. Sixteen participants were chosen through a convenience sampling process (Creswell, 2012), where we invited former students to be interviewed or contacted colleagues who recommended their former students. Amber interviewed three pre-service elementary teachers and five first-year elementary teachers from a large Southwestern city in the United States. Shelly interviewed four pre-service secondary teachers and four first-year secondary teachers from a large Midwestern city in the United States.

Semi-structured, retrospective interviews were conducted in one-on-one settings. The use of retrospective interviews can generate some criticism, because interviewers try to get participants to recall and then reconstruct past experiences from memory. Although these interviews are the least likely type of interview, "… to provide accurate, reliable data for the researcher" (Fraenkel & Wallen, 2000, p. 510), the nature of our research question required us to use retrospective interviews. However, we trusted that the participants' memories were accurate based on *their* perceptions, which were their realities.

The interview protocol included demographic data questions, 11 open-ended questions about textbook use, and a final question to capture anything else the participant wished to share. Here, we focused on participants' responses to two questions within the interview protocol that related to messages sent by the pedagogy textbook: How did the texts you used in methods courses make you think about how to teach? and Considering your experience in the classroom(s) during and after your methods course(s) do you feel that texts can tell you how to teach? Why or why not?

Each interview lasted about one-half of an hour, and each interview was audio recorded. These recordings were later transcribed. After we transcribed the interviews, we also created a document that grouped participants' responses to each question. This helped us look at each participant's responses to all of the questions and to also look at all participants' responses to each of the questions. To analyze the data by utilizing a grounded theory constructivist design, no *a priori* categories for participants' responses, we focused on the meanings ascribed by the participants in the study (Creswell, 2012) and captured their experiences with texts in mathematics methods courses. During Skype™ researcher conversations we first used *in vivo codes*, labels for categories that were phrased in the exact words of the participants, and then created themes that emerged from the *in vivo codes*. As with most qualitative research, we acknowledge that our conclusions are suggestive rather than definitive.

Findings

When asked about how the texts used in mathematics methods courses made participants think about how to teach, approximately 70% of participants (n=11) mentioned the different strategies and ideas the text provided for teaching different concepts. While participants mentioned other aspects of the texts in response to this question, no other response had the same collective agreement by participants (see Table 1). There were only three other responses to this question that were given by at least three participants: an emphasis by the text on student explanations to strategies and solutions, the text leading to a realization of different ways students think about mathematics, and the text as a source of activities for the classroom.

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Table 1: Responses to "How did the texts you used in methods courses make you think about 'how to teach?'"

Common Response	Number of Participants
By providing different strategies/ideas for teaching concepts	11
By emphasizing student explanations	4
By helping me see that students think in different ways/that there are different learning styles	4
By being a source for different activities	3

Mathematics methods courses often focus on pedagogical skills and knowledge, pedagogical content knowledge, and how students learn in order to help pre-service teachers develop teaching strategies aligned with these areas. Both the frameworks surrounding methods courses and the texts selected by course instructors work towards building pre-service teachers' knowledge in these areas. Yet, when we asked participants if they felt that texts could tell them "how to teach," about half of the participants (n=7) did not think the text could do this (see Table 2). Six participants gave mixed responses (yes and no), and three participants reported that pedagogy texts could tell them how to teach. Throughout these responses, four themes emerged that described participants' views related to if texts could tell them "how to teach."

Table 2: Responses to "Considering your experience in the classroom(s) during and after your methods course(s) do you feel that texts can tell you 'how to teach?'"

Response	Number of Participants
Yes	3
Yes and No	6
No	7

Textbooks as a Platform for Reflection

One theme focused on using texts as a platform for reflection on teaching. One participant said:

> Texts can kind of guide you in the right direction and sort of get you to reflect on your own teaching practices. It's very just reflective…like what would it look like in my classroom? Can I get my students to the same endpoints using those methods? (participant 2, first-year teacher).

Yet, another participant viewed this question in a more personal way and stated:

> I think it's beneficial to have texts to give you a solid, to give you a concrete example of what someone else thinks and I think those are beneficial because thinking about other people's thinking is as important as thinking about your own thinking…How can you teach people to teach when teaching is such a personal thing…I think that you have to find your own connections with everything. (participant 5, pre-service teacher)

Both of these quotes from participants emphasize the connections prospective teachers make between the information in the textbook and their own teaching practices. Yet, when asked in the preceding interview question about how the texts they used in their mathematics methods courses helped them think about how to teach, only one participant's response mentioned the textbook providing a reflective component.

Experience is the Best Teacher

Another theme that emerged was that texts cannot tell you how to teach, because experience is the best teacher. As one participant described:

> But, when you're in the thick of it, that's when you really learn, I think, you know experimenting and using the ideas that you have, bringing them into the classroom is the most effective. So, kind of a combination of both, but I don't think the book alone can tell you how to teach. (participant 9, first-year teacher)

This feeling was echoed by other participants, including one who explained:

> I feel like [the texts] can't [tell you 'how to teach']. I definitely think they help…But actually being up in a classroom and teaching and getting the feedback from your students, I think that's going to teach you the most. (participant 13, pre-service teacher)

Perhaps, being in the classroom is when it becomes "real" to prospective teachers. In fact, when asked about how the texts used in the mathematics methods courses helped him or her think about how to teach, one participant shared, "I didn't think about how to teach. That's why I think it was such a shock for me going into my 5th grade [placement] classroom" (participant 14, pre-service teacher).

All Students are Different

The next theme that developed from participants' responses was that textbooks did not tell them "how to teach," because all students are different. Interestingly, most of the participants expressing this view were first-year teachers. The response of only one pre-service teacher fell into this theme. That participant said:

> I think the text tries to tell you how to teach and it gives you strategies but a lot of teaching is based on your students and every student learns differently…I think it gives you a general overview and best practices but every teacher is gonna [sic] have to change their teaching for the students that they have in their classroom. (participant 1, pre-service teacher)

One of the first-year teachers whose response fit this theme expanded upon the notion of knowing your students to knowing the community of students:

> There are so many different parts to teaching. There's knowing your kids…So, in the most straightforward sense, no, I don't think [the text] can teach you how to teach…This textbook is for, you know, just a general population of elementary and middle school teachers but we all go off into our own types of communities. (participant 11, first-year teacher)

We also saw the realization of the different ways that students think about mathematics emerge as a common response to the preceding interview question about how the texts participants used in their mathematics methods courses helped them think about how to teach.

Textbooks do not Reflect Reality

The final theme that emerged through participants' responses to these two interview questions concerned the differences between the text and the reality of teaching. Participants often commented that texts represented a "perfect world" of teaching. As one participant explained, "I feel like textbooks can be very idealistic or optimistic and everything's going to go well and the students are going to get it" (participant 12, first-year teacher). This sentiment was echoed in several responses from participants, particularly those participants who were first-year teachers. According to one of the first-year teachers, "How did [the text] make me think about how to teach? I think the way that it made me think isn't like reality once you start doing it" (participant 16, first-year teacher). This is troubling, particularly if it impacts how teachers view their preparation. "You're not going to get a textbook situation in your teaching environment…it's a completely different world when you step into the classroom versus reading a book…I felt almost unprepared for the real world" (participant 4, first-year teacher).

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Discussion and Implications

The results of our interviews emphasize the different ways pedagogy textbooks are viewed by pre-service and first-year teachers concerning ideas on how to teach. Surprisingly, approximately 81% of participants (n=13) either did not think pedagogy textbooks could tell them how to teach or were mixed in their responses. Only three participants indicated that methods texts could tell them how to teach. While the authoritative nature of texts is often considered when studying textbooks (Haggarty & Pepin, 2002; Herbel-Eisenmann, 2007; Herbel-Eisenmann, 2009; Smitherman, 2006; Weinberg & Wiesner, 2011), participants in this study did not seem to heed the assumed authority of the text on how to teach.

Based on participants' responses and the themes that emerged through them, we suggest that prospective teachers view teaching in a more personal manner than portrayed through pedagogy texts. Many viewed teaching as complex and multi-faceted, and the authority of the textbook conflicted with this view. While the textbook was influential in providing some participants with ideas about the different ways students learn and think about mathematics, several participants also felt tensions between the portrayal of classrooms within the textbooks and their own classroom experiences. We hypothesize that this tension stems from the Platonist view that textbooks present about math and mathematics education (Herbel-Eisenmann, 2007; Smitherman, 2006). If, as Smitherman posited, the notions that shape prospective teachers' expectations about what it means to teach mathematics include that replication is possible and predictable cause-effect relationships, then they may very well think that the textbook represents a "perfect world" of teaching.

The tension between the presentation of classrooms in the textbook and the participants' classroom experiences may also be the result of a misalignment between the intended reader, the implied reader, and the empirical reader (Weinberg & Wiesner, 2011). The participants being the actual readers of the texts (the empirical readers) may not match the profile of the readers the authors envision (the intended reader) and/or may not possess the qualities needed to read the text in the ways the authors intended (implied reader). What skills do prospective teachers need to read the textbook in a way that lessens this tension? Do they need additional classroom experience? Do they need more confidence in their perceptions of mathematics education? Or, do they need a stronger avenue to voice those perceptions? Perhaps, there are other factors that need further research in order for the intended, implied, and empirical readers to align when facilitating the use of pedagogy textbooks in our mathematics methods courses.

That being said, we posit that these tensions signify positive aspects in our participants as readers of the texts. The results of our interviews also suggest that participants leaned towards a critical stance when they indicated that textbooks could not tell them how to teach. This questioning of the texts is something that we would like to promote in our methods courses. Like Draper and Siebert (2004), we agree that for pre-service teachers to "acquire mathematical knowledge and participate meaningfully in mathematical activity, [they] must become adept at creating, negotiating, and consuming texts" (p. 945).

We want to position the textbook as a source of information, not *the* source for information. Helping the students in our methods courses to question and negotiate the information presented in the various texts helps create a "privileging the student" position (Herbel-Eisenmann, 2009) between the students in our methods course, us (as instructors), and the textbook. Furthermore, if we allow these tensions and the classroom experience to be exposed and discussed, we help prospective teachers create their own texts. The results of our interviews suggest that participants viewed experience as the best teacher of how to teach. Several of our participants also recognized that all students are different and responding to the needs of students in the class is important as teachers plan. We look for ways that these ideas can be recognized and built upon in our methods courses to foster the confidence of prospective teachers and position them in ways that value their contributions along with the information presented in the textbook.

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Textbooks influence both prospective teachers and instructors of mathematics methods courses. We do not want to downplay their use or their importance in our courses; there is valuable information that comes from textbooks. Instead, we want to position the textbook in a way that mirrors this statement by Herbel-Eisenmann (2009), "When teachers, textbooks, and students come into contact with one another, there is the potential for each of these 'participants' in the classroom to take on responsibility for the introduction and development of mathematical knowledge" (p. 147). Indeed, we want to leverage textbook use in ways that prospective teachers will find meaningful in both their teaching preparation and in their teaching careers.

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