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Graduate Level Mathematics Curriculum Courses: How Are They Planned?

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Even though there is much research related to the teaching and learning of K-12 mathematics, there are few studies in the literature related to university professors' teaching. In this research report, I investigated how three professors of mathematics education structure their graduate level curriculum courses. The results show that three factors influence the ways that the professors design this course: (a) their view of mathematics curriculum, (b) their view of graduate students' contributions to classroom atmosphere, and (c) their learning goals for the graduate students.

One of the goals in writing this article is to make the practice of teacher educators more public. This goal was motivated by Shulman's (1998) exhortation to teacher educators:

> Now, think of your functioning as teachers. How much of what you do as a teacher—these great acts of creativeness, these judgments you make all the time as a teacher, the courses you design, the internships you tinker with, modify and strike gold with—how much of that ever becomes public? How much is susceptible to critical review by your colleagues or becomes a building block in the work of other members of the teacher education community throughout your own institution, much less the nation or the world? (p.18)

Preparing to teach a mathematics curriculum course requires more than deciding what mathematics topics to teach and in which order, as is the case for many content courses. It requires more than choosing K–12 mathematics classroom ideas to analyze with future teachers, as is the case in some methods courses. Preparing to teach graduate-level mathematics curriculum courses is a complex endeavor because these courses involve the integration of various aspects of mathematics education—curriculum, content and children's mathematical learning—with the goals of educating graduate students. Such complexity seems to warrant the investigation of how professors design graduate-level mathematics curriculum courses. However, there are not many studies investigating how university professors conceptualize the courses they teach, especially graduate-level mathematics curriculum courses. This study had two purposes: (a) to gain insight into university teachers' decision-making processes in planning a graduate-level curriculum course and (b) to make these insights public so that educators who teach or plan to teach similar courses will have a stronger base of information to guide their decision-making processes.

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Literature Review

Shuell (1993) stated that teaching and learning at all grade levels are dynamic and reciprocal processes and that research should attempt to account for the complex and simultaneous effects of developmental, affective, and motivational influences, as well as cognitive factors. Many investigations of K–12 mathematics teachers' practices have been conducted to explore motivational influences and cognitive factors that affect these complex reflexive processes (e.g., research on teachers' knowledge, beliefs, and motivation). However, there is a paucity of research on university professors' motivation or cognitive processes when they reflect upon their practice as teachers of graduate level mathematics education courses.

Looking beyond mathematics, there are a few general studies of university professors' beliefs about students' learning, and how they perceive their practice as course instructors. For example, considering professors' teaching practices, Kugel (1993) theorized that professors undergo three stages of development as teachers: self, subject, and student. During the first stage of their career, professors primarily focus upon their own role in the classroom and how they feel about their own abilities, i.e., self. In the second stage, professors focus on teaching the subject, which

includes the subject matter and the materials they use when teaching. In the final stage, professors focus on students and how they learn. This stage is the least stressful part of the development, according to Kugel, because at this stage professors have already mastered the previous two, and are better prepared to focus on their students. Kugel admitted that not necessarily all professors experience these stages, but he claimed that they were a commonality in the experiences of many.

Stark and Lattuca (1997) made an additional generalization about professors and wrote about their unsystematic way of thinking and acting in their teaching practices:

> Instructional methods are chosen more often according to personal preferences or trial and error rather than through systematic attention to [the] nature of the expected learning, the nature of the student group or audience, and many varied practical constraints, such as size of the class (p. 288).

In contrast to these authors, I believe, most professors use some trial and error in their classroom in a systematic way. They revise their practice considering the learning goals for their courses and the nature of the student group. Therefore, the definition of trial and error and how it affects teaching needs more investigation at the graduate level. Hence, there is a need to understand how professors take into consideration the nature of the material they want to teach, the group of students they teach, and their expected learning goals when making decisions on how to teach the course differently. With this study, I hoped to gain insight in these issues.

Jackson (1994) observed: "We do not know what teachers in higher education think about their teaching and we do not know the cognitive processes in which they engage when they develop curriculum" (p. 2). In her study, she interviewed 11 university professors from different disciplines to understand their conception of curriculum design. In particular, her principal questions were “How do university teachers see themselves as curriculum makers; how do they think and make decisions about their teaching; how do they interpret their experiences and give meaning to their work?” (p. 2). In her findings, Jackson indicated that professors’ decisions about the curriculum design of a course are based upon the context of the course as well as their individual and disciplinary values.

As a summary, Kugel (1993) indicated what professors might focus on when they reflect on their practice, whereas Stark and Lattuca (1997) suggested that unsystematic trial and error might be part of professors’ practices. In addition, Jackson (1994) claimed that context and values play a fundamental role in professors’ designing processes at the undergraduate level. These general studies offer some insight into investigating how mathematics education professors conceive their practices. However, there is still a need for studies that investigate professors’ design processes for graduate-level courses, where many students are mature adults coming to school to learn more about their own profession. Thus, this study focuses on the following research question: How do university professors decide what to teach in graduate level mathematics curriculum courses?

Research Design & Methods

The study consisted of three cases. Patton (2002) said, "Cases are units of analysis. What constitutes a case, or a unit of analysis, is usually determined during the design stage and becomes the basis for purposeful sampling in qualitative inquiry" (p. 447). In this vein, I selected three professors who approach teaching from different theoretical frameworks as my units of analysis. These professors, Martin, Rafaela, and Adam[1], all have taught mathematics education courses at the undergraduate and graduate levels.

To a certain extent, this study was an intrinsic case study (Stake, 2000) because I had a personal interest in trying to better understand the selected cases. As both a graduate student and a future instructor of curriculum courses, I was interested in how those particular professors decided what to teach in their curriculum courses and how they perceived graduate students. I used interviews and course artifacts to get detailed information about the cases and interviewed each participant for one hour. An overall interview guide (see Appendix) was developed for this semi-structured interview. The use of the interview guide followed Patton‘s (2002) suggestions:

> The interview guide provides topics or subject areas within which the interviewer is free to explore, probe, and ask questions that will elucidate and illuminate that particular subject. Thus, the interviewer remains free to build a conversation within a particular subject area, to word questions spontaneously, and to establish a conversational style but within the focus on a particular subject that has been predetermined. (p. 343)

The interview guide consisted of ten open-ended questions. The foci of the guide were the professors’ understanding of curriculum, their goals for the curriculum course, and the difference between teaching

graduate level mathematics education curriculum courses and teaching undergraduate mathematics content and method courses. The interviews were audiotaped, transcribed, and analyzed. Participants were asked to answer follow-up questions based on the initial data analysis. I also collected course syllabi, selected books, organized readers, and other artifacts used in these professors' courses to help with the analysis of the interview data.

Context and Participants

This study focused on a graduate-level curriculum course taught in a large university in the southeastern region of the United States. The course was listed as a three credit hour graduate course in the university graduate catalog, and had the following description: "Mathematics curriculum of the secondary schools, with emphasis on current issues and trends." It was a required course for graduate students in the master's program. In addition, several doctoral students chose to take the course as preparation for doctoral-level advanced curriculum studies if they had not taken a similar course in their master's program.

One female and two male professors participated in this study. One of the participants, Martin, had taught this course more than 20 times. The last time he taught the course, Martin used videotapes from the Third International Mathematics and Science Study (TIMSS) to discuss curriculum and analyze current curriculum issues. He also used recent publications from the National Council of Teachers of Mathematics (NCTM) and the state's K–12 mathematics standards. In addition, Martin drew upon his own articles and experiences related to curriculum development.

Rafaela had taught this course three times at this institution. Every semester, she began this course with a book called *The Saber-Tooth Curriculum* by Peddiwell (1939) to create a discussion about the nature and purpose of curriculum. She also valued NCTM's (2000) *Principals and Standards for School Mathematics* and thought of NCTM's standards for the K–2 grade band as the basis for how she conceptualized K–12 mathematics education. Rafaela divided each course session into two parts. In the first part, she conducted a more theoretical discussion of selected articles regarding current issues in mathematics education curriculum (e.g., "math wars" or equity). In the second part, she incorporated activities and investigations related to mathematics education curriculum. For example, she recently used innovative curriculum materials that were funded by the National Science Foundation. She asked her students to consider what their classrooms would look like if they taught with these curricula.

The third participant, Adam, had taught this course five times. He did not ask students to read articles or have discussions about curriculum in his course; rather, he preferred to work on their mathematical knowledge by engaging them in mathematical investigations. Adam's aim was to make mathematics teachers creators of curriculum by strengthening their mathematical knowledge.

Data Analysis

After analyzing the cases individually, I searched for themes that cut across all three cases. Three themes emerged: professors' views of curriculum, their views of graduate students' contributions to the course, and their learning goals for the graduate students. In the remainder of this article, I focus on data related to these three themes.

During the analysis, I realized that the three participants did not share similar conceptions of what I considered to be basic terminology, such as mathematics curriculum. For example, Martin's focus was on curriculum as instantiated by textbooks, state standards and other documents. Rafaela and Adam, on the other hand, deeply questioned what curriculum is. However, Rafaela and Adam's ways of questioning curriculum also differed due to their backgrounds and roots in mathematics education.

Views of Curriculum

What is curriculum? Clements (2002) summarized a few classic definitions of curriculum in the United States as follows: the ideal curriculum is what experts propound; the available curriculum is the textbooks and teaching materials; the adopted curriculum is the one that is adopted by authorities; the implemented curriculum is what teachers teach in the class; the achieved curriculum is what students have learned; and "the tested curriculum is determined by the spectrum of credibility tests" (p.601). The three different perceptions of curriculum that emerged in this study are related to different aspects of curriculum as defined by Clements.

Martin's view of curriculum was closer to the idea of the available curriculum. For him, mathematics curriculum is represented in textbooks; curriculum is how teaching materials are organized. Because of the importance he gave to this view of curriculum, Martin used many different curriculum materials in his course. He discussed how these materials are organized, and why certain things are added to or omitted from school

mathematics curriculum. In doing so, he followed the history of the available mathematics curriculum.

> Interviewer: What are your goals for your students in this course?
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> Martin: Well, I want to get them [the grad students] to analyze, first of all the structure of the curriculum. How the curriculum is [organized], that is really, where we start usually. The structure of the curriculum, how the U.S. curriculum is organized, and why it is organized the way it is, and various attempts to change the organization. How new topics have come in, how other topics have gone away, how certain things have been emphasized in different times. So when we look at old textbooks, we look at the kinds of problems that are posed, we look at the organization of topics, we look at how, and what definitions are offered for certain things. To compare them with each other and to see, for example, how certain definitions have changed, or how the kinds of activities in the books have been changed.

Curriculum for Rafaela included a wide spectrum of issues and, when talking about curriculum, she utilized many of the aspects mentioned by Clements (2002). To her, curriculum is not just textbooks or that which is taught by mathematics teachers: curriculum is a complex political and theoretical concept. She encouraged her graduate students to discuss what curriculum is and how it affects students and teachers in K-12 schools. Even though Rafaela incorporated some discussion on curriculum theory into her class, she believed there were underlying expectations at her university about what to teach in this curriculum course, e.g., history of curriculum and NCTM Standards. When asked why she did not include more theoretical discussions of curriculum in her course, her answer provided insight into her ideas about curriculum.

> Interviewer: What do you think why you don't talk about it [the theory]?
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> Rafaela: The way I read what it says in the description of the course, this is not really a theory of curriculum course. It is math ed. curriculum in schools … so I understand it more as a discussion of curricula that is out there. Because I have taught curriculum theory classes, I try to include some of the theory in my class. So, in my class we talk about things like different types of curriculum. I try to get students to think about what is curriculum: is it your textbook, is it the politicians? … We talk about hidden curriculum: the things you teach but you don't even know you are teaching, like values … so I bring all that in …

Adam included both teachers' and students' actions in his definition. This definition combines Clements' notions of implemented and achieved curriculum. Adam's view of curriculum was not related to what is in textbooks or how they are organized. Thus, he created curricula based upon the actions of his students as he taught these courses. He modeled his view of curriculum for his students by using mathematical investigations. Based on his knowledge about what is essential middle- and high school-aged children's mathematics, Adam formed a possible curriculum, what it should include implicitly, and then further developed the investigations for his students as he interacted with them throughout the course.

> Interviewer: How do you perceive curriculum?
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> Adam: … You can view curriculum like books on the shelf: it is already in place. It serves me to teach and it is objective. That is one view to curriculum that is a normal view people in mathematics education take. … It is already there in place and already there before the teacher. And the teacher just implements. My view of curriculum is quite different: my view of curriculum is, it is done by the teacher and by the student, it is a dynamic growing, evolving thing, defined by the participants in the classroom.

Views of Graduate Students

When talking about the graduate students in his course, Martin mainly focused on their teaching experiences. He saw that the classroom discussions changed immensely depending on whether there were many graduate students with teaching experience. Hence the teaching experiences of the students enabled him to conduct the undergraduate- and graduate-level curriculum courses differently.

> Interviewer: So, was summertime different than how you taught it [the graduate course] in spring or fall semester?
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> Martin: Well, summertime is, of course, shorter. It makes the course a little bit different, but the course is basically the same. What changed the course the most is whether most of the students have done teaching. I had classes where almost everybody had teaching experience, if not everybody, so these were experienced teachers. On the other hand, I've taught [when] almost nobody had done any teaching except possibly, student teaching, and that makes the course very different. That makes more of a difference, I think, than when the course is given, whether it is given in the summer …

> Interviewer: So you think that there are differences between those graduate students because …
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> Martin: If they have never taught, then there are some of these issues [that] don't occur to them or are not realistic for them. Or they have trouble seeing some of the issues. Let me give one example. I have in recent years—since the TIMSS video studies came out—I have occasionally used the TIMMS videos. I have shown it in the course to discuss curriculum issues. I have shown it in [another graduate course] also, but occasionally shown it in [the curriculum graduate course] so we can talk about some … curriculum questions … We were concentrating in that course only [on] American teachers [in the videos] … and I've noticed that they [graduate students with teaching experience] see different things; they notice different things about the topics that are being taught. … They have different reflections on the video.

Martin could do more in the graduate-level course by using different curriculum materials and readings about the history of school mathematics because curriculum is more real to graduate students who have taught and experienced it in their professions.

> Interviewer: Are there any courses for undergraduate curriculum?
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> Martin: Yes. Mostly in that course we remind them [undergraduate students] what the curriculum looks like and there is very little history. …There is not very much analysis of new materials—some innovative materials. There is a little bit of look at new textbooks, … but we try to balance that because we recognize that most of these people would not be using these new materials right away... so part of what we try to do is familiarize them with the most common materials out there. And again, since none of them have taught … in that course, it is really a very different orientation because usually in [the graduate curriculum course] you can expect some people have done some teaching, and so they can talk about some of these curriculum ideas from their own perspective: this is what we had in our school, these are the materials, this is what we like, this is what we didn't like, and so forth. The undergraduate course doesn't have that kind of discussion.

Rafaela also indicated that as a professor she could try different things with her graduate students compared to her undergraduate students. On the other hand, her vision of graduate students not only differed in their teaching experiences but also in their willingness to try NCTM materials. Rafaela believed that most graduate students who live in the academic environment are familiar with NCTM (1989, 2000) standards and already believe they can teach with these standards. On the other hand, she observed differences among the graduate students who are currently practicing teachers. These graduate students had varied views of NCTM's standards and other reform-oriented curriculum materials. She thought that these practicing teachers especially needed to be exposed to NCTM standards in order to analyze their own teaching practice and observe similarities and differences between their practice and Standards-based teaching. Therefore, to accommodate these practicing teachers, Rafaela planned student demonstrations of teaching a topic from non-traditional textbooks as an important part of her curriculum class.

> Rafaela: I don't think it is my goal to convince them [about NCTM standards]. I think my goal is to help them analyze what they believe. They can be critical and write a paper about why they don't agree with that [NCTM standards]. So, I think, especially teachers, they finish the course thinking that it is a good idea, but you can't really implement it. Some of it, it is hard to convince them that they can do it. And in the methods course, I am more interested in convincing them what they can do. I don't do as much of that in the curriculum course. But I try to give them a vision of what it would look like if they were to try it. And I have changed the materials used in the course over the years. Last year we had Connected Mathematics Project materials. … Two or three of the students would be teachers from that class and we were the students. Because I started noticing that some of the students didn't have a vision: "What would it look like if I were to do what the standards say? If I wanted to do that in the classroom, what does it look like?" … So I started giving them more of an idea, well, this is a different thing. Some of them liked it … I am just talking about the classroom teachers who come back, not the regular students who are in this environment that talk about NCTM and change. … Two years ago, I had one classroom teacher who came to me and said, "I am very lost. You really took the carpet from my feet" … for him things could be different … and I have had other students saying that "I have been doing that but I did not know how to call this." But I also have had teachers, come and leave thinking that I am a dreamer. You know, anything I said is not possible.

Similarly to Martin, Adam mainly talked about how he viewed the graduate students and their contributions to his teaching by comparing them to his undergraduate students. Graduate students' teaching experience was an important component of how he

viewed graduate students and their contributions. Teaching experience provided the possibility for graduate students to be involved in secondary school students' mathematical thinking. For Adam, having previously engaged in students' mathematical thinking made graduate students more able to appreciate the importance of the basic mathematical concepts and operations they investigated in his course. These graduate students were able to establish meanings of basic ideas in mathematics from the point of view of a teacher, not just a student.

> Adam: It is very difficult for them [undergraduate students] because they are struggling. They struggle for the actual thinking that is involved. … There is a qualitative distinction between the natures of the students in the two courses.
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> Interviewer: Nature of the students?
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> Adam: The way students view themselves, the way they view what those courses should be about. … [Undergraduates] are not as mature as graduate students in actually working with students. They just did not have a chance to become involved with others people's thinking. So, they don't appreciate how important their thinking is in trying to understand the thinking of other students. So, their basic orientation in [the undergraduate course] is not to understand the thinking of the students. It is more, "what do I have to do when I go teach the topic that is already given?" That is their orientation.
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> Interviewer: But don't some students have that kind of orientation in [the graduate] class?
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> Adam: Oh yes. By all means, they had that orientation. But I think they are more mature and probably little bit willing to consider the possibilities. OK. But [for the] most part few students that went through the course always knew what we were doing and quite appreciated what we are doing. The distinction between [the] two classes is quite profound in the maturity of the students and appreciation for investigating basic mathematical concepts and operations [and the] meaning of basic ideas in mathematics from the point of view: How do I make these things? How do I make meaning for them? How do I formulate a constructive itinerary of mathematics and the relationships and the connections to mathematics? I think [the graduate course] students are much more able to deal with that than the [undergraduate course] students.

Goals for Graduate Students

Martin's overall goal was to make students aware of current curriculum issues. For this goal, discussing NCTM's (2000) new standards was important for him.

> Interviewer: What is the purpose when you are using NCTM standards and why do you want to use those?
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> Martin: Well, to acquaint them [the students] with some of the issues in the field. These current publications reflect efforts in the profession to change, in the case of the curriculum standards, to change the curriculum. So, I think it is important for them to know what people are advocating. … I usually add in some critiques of this, or if we don't read a critique we actually make a critique ourselves, … especially if they are experienced teachers, they don't necessarily agree with all of the things that are in these documents so we discuss them. … So, my purpose is to get them thinking about current issues… As it says here [pointing to his course syllabus], I wanted them to … "gain some skill in analyzing issues and trends." Because these people, whatever they end up doing in [their] profession, they are going to be using, or at least knowing about, curricula and they are going to know, I hope, that [there] will be issues out there.

Martin felt that graduate students needed to look at mathematical topics locally (for a grade) and globally (across grades) when discussing curriculum issues. For example, he discussed the emphasis on proof in NCTM's 2000 standards as opposed to the earlier *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) and added that there would always be debate on certain curriculum issues, such as the inclusion of real life applications and technology. Hence, his goal was to make graduate students aware of those issues and enhance their skills in critiquing those issues.

> Martin: For example, how much emphasis should be put on proof? … now we have PSSM and a stronger emphasis on proof, … but … the 89 Standards didn't emphasize it.…the way that 2000 Principles and Standards is structured, it raises the question of what is to be done about proof in early grades and what is to be done about proof at the later grades. And this raises questions of how the curriculum is organized across the grades. Even though the focus is on the secondary curriculum, there is always a question, "How does it build on the elementary curriculum?"

Rafaela's overall goal was related to her conceptualization of the curriculum. Similarly to

Martin, she wanted graduate students to think about and reflect on curriculum. However, her goal was to make an implicit change in graduate students' teaching practice. She wanted them to think about how curriculum played a role in their own teaching and the effects of their use of curricula on their teaching. Rafaela believed in the existence of a hidden curriculum that teachers implemented but were not aware of. Therefore, her goal was to help graduate students clarify their own teaching goals.

> Interviewer: What are your goals? Is it the little course description?
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> Rafaela: To think about, "What is curriculum?" is my goal, probably because…I come from this curriculum studies perspective. … You have to decide, what do you want to teach? As a teacher, what are your goals? And those are things, I can't help anyone to decide but I can help them to think about it. So, my overall goals are to bring the class … to think … "Yes, there is a hidden curricula that I teach and never thought about …Why am I teaching this? What kind of people am I trying to educate? What [are] my goals as a teacher for my students?" … That is what I want them to reflect on. Inside that there is my view that … we want to create thinkers. … I think the NCTM standards … are a good venue for helping create thinkers who reflect mathematically … so I do present it from that perspective. …Who decides all those things? Who decides the curriculum? Who decides [the state standards]? Do we have to follow? What kind of people are we going to create by following that?

With this course, Adam also wanted to make a change in his graduate students' educational experiences. His main goal was to reorient graduate students to think about the basics of school mathematics. In order to understand and value K–12 students' mathematical activities, he believed that teachers need to have mathematical experiences such as understanding and formulating mathematical rules they use everyday in their teaching. Therefore, he provided learning opportunities in mathematical investigations and hoped graduate students would develop meaningful itineraries for some mathematical topics.

> Adam: How the teacher thinks is totally critical. … How students think is totally critical. So, my view of curriculum is manifested in how I acted in the [graduate] course. I involved … the participants deeply in doing basic mathematical activities in a way that they probably haven't thought about before. … Investigate the basic ways of reasoning in mathematics, the basic meaning of … linear functions. … Where they come from, what is the constructive itinerary for that? So, I want the participants to become aware how they think mathematically. OK. I want them to be aware of what they are doing mathematically … For example, addition of fractions: half plus a third is viewed as a procedure, as an algorithm. … I want them to go back to very basic ways of reasoning … How would I formulate that for the sum, if I don't know already those rules? What do those rules mean? … I think that attitude is very essential for teachers because they have to respect … productive thought and creativity, and potential creativity, of the students. So, they are not just giving the mathematics procedurally to students, but the students are constructing it meaningfully.

Final Comments

Depending on the professor, the learning experiences graduate students have in this curriculum course may differ immensely. The professors' views of curriculum (e.g., static as in textbooks or already given as in the school standards versus dynamic views), views of graduate students, and their goals for the course influenced what kinds of materials they chose and how they used these materials.

Martin, Rafaela, and Adam all believed this curriculum course should make graduate students better thinkers and better analyzers. Whereas Martin and Rafaela focused on discussing existing curriculum materials when talking about their learning goals, Rafaela was also concerned about changes in her students' teaching practice. Adam, on the other hand, focused on helping graduate students become better at analyzing their own and their K-12 students' mathematical activities.

The professors' learning goals were closely connected to their views of curriculum and their views of graduate students. For example, because Martin regarded school mathematics curriculum as textbooks, written documents, and the evolution of mathematical topics in those documents over time, he took these components into consideration in his planning. Martin focused on the organization of the materials with his graduate students and used a variety of current and historical curriculum materials for that purpose. He aimed to help his students better analyze current issues. In addition, he viewed graduate students' teaching experiences as the factor that most affected the quality of discussions.

Rafaela also used reading materials, but she concentrated on the discussions of how graduate students conceptualize curriculum, what NCTM standards mean in terms of teaching and learning, and

who is making curriculum. For Rafaela, curriculum meant a theoretical discussion of teaching practice, so using NCTM materials as an orientation was a good venue for that purpose. She believed that some of the graduate students, mostly the currently practicing teachers, were hesitant to think about curriculum differently. Therefore, NCTM and other reform materials provided a context for this discussion. Using this context, she could expose teachers to new ideas that they could try in their practice.

For Adam, curriculum was a dynamic phenomenon that is formed by teachers and students in the classroom. He thought graduate students should be creators of curriculum, like him, with their own students inside the classroom. In his classes, he tried to provide a model of this view by dynamically creating a curriculum with his graduate students. Teachers' mathematical knowledge, as well as their teaching experiences, played an important role in that creation. He interacted with graduate students using a mathematical domain as the medium. His aim was to provide opportunities to graduate students to rethink mathematics curriculum in schools by engaging them with the basics of mathematics.

This investigation of a graduate-level curriculum course reveals that various factors affect the ways in which professors design graduate-level courses. However, further research is needed to investigate the learning experiences of graduate students and how professors' ideas about teaching curriculum are compatible with their practices in the classroom.

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[1] All names used in this article are pseudonyms.

Appendix: Interview Protocol

1. How many times have you taught this course? Have you taught similar courses in different institutions?
2. How is this course different from any mathematics education content courses or method courses you taught before? How does curriculum have a special or different emphasis in your design of the course?
3. What are your goals for the course? How do these goals affect your decisions when you are designing the course?
4. Since this course is for graduate level students, how do you take this audience into consideration (graduate students might be in-service teachers) when you design the course?
5. How do you know your graduate students understood the curriculum ideas emphasized in the course? How do you check it?
6. What components of the K-12 mathematics curriculum are important in your design of this curriculum course? How do you know you have emphasized them enough when teaching this course?
7. How do you revise the content of the course or the way you teach the course each time? What factors do you take into account? (colleagues, recent related research, students' success or responses, the departmental needs, etc.) and How?
8. What would you like to gain as a teacher when teaching this course and how does this affect your design of the course?
9. How does your research affect your teaching of graduate level mathematics curriculum courses? Or vice versa?
10. In which ways do you think your [graduate curriculum] class is similar/different from the [graduate curriculum class] taught by other instructors?