EXAMINING THE ROLE LESSON PLANS PLAY IN MATHEMATICS EDUCATION

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Formal lesson plans have long been touted as a best practice in mathematics teacher preparation. Experienced teachers frequently view formal lesson plans as nonessential to the planning, implementation, and evaluation of instruction. We discuss results from an online survey designed to make the perspectives of 60 prospective and practicing mathematics and special education teachers regarding lesson plans explicit. Practicing teachers identified their use of formal lesson plans as a reflective tool and for organization purposes, whereas for prospective teachers lesson plans served as a guide and for accountability reasons. Finally, we describe future mathematics teacher education engagements designed to promote productive yet practical perspectives of formal lesson plans.

Keywords: Teacher Beliefs; Teacher Education-Inservice; Teacher Education-Preservice

Introduction

Planning for a lesson has long been recognized as a primary factor impacting the efficacy of classroom instruction. According to Brahier (2013), "The effectiveness of a lesson depends significantly on the care with which the lesson is prepared" (p. 141). Focused lesson planning has been shown to support teachers' implementations of cognitively demanding tasks, help teachers anticipate students' cognitive challenges, and support the generation of questions teachers can ask that promote and elicit student thinking (Boaler & Staples, 2008; Franke & Kazemi, 2001; Henningsen & Stein, 1997). Smith, Bill, and Hughes (2008) assert, "One way to both control teaching with high-level tasks and promote success is through detailed planning prior to the lesson" (p. 133).

As introduced by Morine-Dershimer (1977) and described by Schoenfeld (1998), a teacher's lesson image is "the teacher's envisioning of the possibilities and contingencies related to a lesson" (p. 17). Furthermore, a teacher's lesson image includes the teachers' expectations for how students will engage with certain tasks or activities, what students might find straightforward or challenging, and potential student responses to the lesson's tasks and activities and how the teacher expects to deal with them (Schoenfeld, 2010, p. 233). As such, a teacher's lesson image incorporates everything related to how the teacher imagines the lesson will unfold (Schoenfeld, 1998, p. 18). Although the idea of a lesson image is more preponderant in literature with reference to experienced teachers, one need not have taught a lesson in order to have some image for how instruction might play out. Therefore, prospective and early career teachers should be motivated to imagine and anticipate how students might engage with instruction, envision the understandings and ways of thinking students might learn from alternative instructional approaches, and the ways in which discourse invites mathematical thinking and reasoning (Grouws & Shultz, 1996; Thompson, 2002).

One tool that encourages teachers to make their lesson images explicit, and potentially objects of thought and reflection, is the formal lesson plan. According to Brahier (2013), "A lesson plan…is a road map that can be used by the teacher to provide structure to the lesson" (p. 165). Furthermore, written lesson plans help motivate teachers to think deeply about their classroom tasks and activities and attempt to anticipate how students might interpret a task, the methods or strategies (correct and incorrect) students might use to make sense of the task and work toward a solution, and how those "strategies and interpretations might relate to the mathematical concepts, representations, procedures, and practices that the teacher would like his or her students to learn" (Smith & Stein, 2011, p. 8). As such, formal lesson plans permeate teacher preparation programs in general and mathematics

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methods classes in particular. As described by Kagan and Tippins (1992), "In virtually every teacher education program, considerable time is spent teaching novices how to write detailed, linear lesson plans" (p. 477).Although much less pervasive, research in professional development in mathematics education has included formal lesson plans as a data generating and analysis component (e.g., Burns & Lash, 1988; Morine-Dershimer, 1977; Smith, Bill, & Hughes, 2008). In addition, the creation and implementation of formal lesson plans and reflecting on how students engaged with instruction has been used with practicing teachers as a means to support teachers' development of instructional practices that promote "framing and solving problems, looking for patterns, making conjectures, examining constraints, making inferences from data, abstracting, inventing, explaining, justifying, challenging, and so on" (Stein, Grover, & Henningsen, 1996, p. 456).

Unfortunately, lesson plans have typically been viewed by teachers as a script or directions for executing a lesson that emphasizes procedures and structures, with "limited attention to how the lesson will help students develop understanding of key disciplinary ideas" (Smith & Stein, 2011, p. 76). According to Kagan and Tippins (1992), "Traditional university coursework may exaggerate the importance of daily lesson plans…[and] an emphasis on detailed written lesson plans may even be somewhat detrimental in that it masks the importance of improvisation" (p. 478). Moreover, research has consistently shown that "experienced teachers do not use written lesson plans…[and] at most…jot down an outline or list of topics to be covered during the lesson, using a cryptic shorthand" (Kagan & Tippins, 1992, pp. 477-478). Practicing teachers tend to regard formal lesson plans as useful only for student teachers or when they need to plan a new unit, perhaps with new standards, or as a required component of a formal administrative observation of their instruction (Kagan & Tippins, 1992).

Purpose of the Study

Disparity between prospective and practicing teachers, regarding the expectations of and value to developing, discussing, and revising formal lesson plans, highlights a need to better understand these distinctions from a situational perspective (Peressini et al., 2004), where teacher learning is "understood as a process of increasing participation in the practice of teaching, and through this participation, a process of becoming knowledgeable in and about teaching" (Adler, 2000, p. 37).In this article we present results from a study designed to better understand teachers' perspectives on the role formal lesson plans can and do play in the teaching and learning of mathematics. Specifically, the study was designed to address the following research questions:

- What are practicing (or in-service) teachers' perspectives on the role lesson plans play in their instructional practices?
- What are prospective (or pre-service) teachers' perspectives on the role lesson plans play in their instructional practices?
- How do practicing and prospective teachers' perspectives regarding lesson plans compare and contrast?

Methods

Study participants consisted of two samples: (a) 28 practicing teachers comprised of middle (grades 5-8) and secondary (grades 9-12) school mathematics teachers and intervention specialists (special education teachers); and, (b) 32 prospective teachers comprised of early childhood (grades K-3), middle childhood (grades 4-9), secondary (grades 7-12), and special education (grades K-12) license seeking teacher candidates. Potential participating teachers were emailed a link to an online survey designed to make explicit their perspectives on the role formal lesson plans play in their practice (see http://kentstate.az1.qualtrics.com/SE/?SID=SV_cCou1lOt7M930zj)

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Survey Respondents (Study Participants)

The survey response rate for practicing and prospective teachers was 31.1% (28 of 90) and 20.1% (32 of 159), respectively. Practicing teachers ranged from first year math teachers to those with 30 years of experience. A comparison of the number of respondents by grade band, specialization, and teacher education program is displayed in Table1 below.

Table 1: Teacher Survey Participants by Grade Band, Specialization, or Program

Practicing Teachers	Number of Respondents	Prospective Teachers	Number of Respondents
Intervention Specialist	13	Special Education Licensure Program	21
Math Content, Grades K-2	0	Grades K-3 Licensure Program	3
Math Content, Grades 3-5	1	Math Content, Grades 4-9 Licensure Program	3
Math Content, Grades 6-8	5	Math Content, Grades 7-12 Licensure Program	5
Math Content, Grades 9-12	11		

Analysis

A situative perspective suggests that knowledge, beliefs, and practices are indissoluble from the situations in which they occur (Putnam & Borko, 2000). As such, learning to teach mathematics "occurs in many different situations—mathematics and teacher preparation courses, pre-service field experiences, and schools of employment" (Peressini et al., 2004, p. 67). The samples of teachers examined here represent individuals at different ends of a teacher-learning trajectory: teachers at the mathematics methods stage (prior to student teaching) and teachers at various levels of experience as practicing teachers.

In the following section, we examine and compare practicing and prospective teachers' perspectives on the role formal lesson plans play in their practices. We focus on two specific comparisons: (a) the role of lesson plans for prospective teachers, and (b) the role of lesson plans for practicing teachers. Analysis involved both qualitative and quantitative methods.

The role of lesson plans for prospective teachers. Survey respondents were asked their perspectives on the role lesson plans serve prospective teachers. Practicing teachers indicated a wide spectrum of perspectives. Sample responses included, "Prepares you to think about all of the things that can occur in a period…makes you start thinking about how to organize the time in class" and, "They help a pre-service teacher realize and get used to every aspect that is involved in teaching on a daily basis. It helps with time management and relating teaching to things that are meaningful in students' lives."

Individual members of the research team, which consisted of the course instructor and three graduate students enrolled in a graduate level course on mathematics education research, examined practicing teachers' responses and developed themes with which to categorize these responses (Strauss & Corbin, 1998). The entire research team then reviewed and discussed each category, category (theme) descriptors were made consistent, and teacher's responses were re-classified to support coding reliability. The final categories arrived at through examination and discussions align, to a degree, with Clark and Peterson (1986) "types" and "functions" of planning. In order to provide

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a better understanding of the categories (or themes) the research team settled on, it will be beneficial to exemplify what we considered a representation of each (Table 2).

Table 2: Sample Practicing Teachers' Responses in Regards to Corresponding Categories

Category (Theme)	Sample Practicing Teacher Response
Confidence	"The lesson plan can add to their confidence…"
Guide	"[Lesson plans give] you have a general idea of what you want to accomplish and how you are going to do it." "[Lesson plans] help them understand what they have to know."
Instructional Flow	"[Lesson plans] do help a new teacher understand the flow of the lesson..."
Keep on Track-Accountability	"[Lesson plans]…make sure standards are taught."
Keep on Track-Locally	"[Lesson plans] forced me to put things on paper, such as time spent on an activity…" "It helped me to have typed lesson plans early on because included everything I was to cover in the lesson."
Keep on Track-Globally	"[Lesson plans] help a new teacher understand the flow…of the week/month…[and] can help a new teacher…transition from one unit to the next."
Organization	"[Lesson plans] helped [me] to learn what goes where and how to find the resources." "[Lesson plans] help structure their day when feeling overwhelmed."
Reflective Tool	"[Lesson plans] prepare you to think about all of the things that can occur in a period." "Thinking about how to tie lessons to each other as well as the standards looking for connections."
No Productive Purpose	"None."

Prospective teachers also indicated a wide variety of perspectives regarding the role formal lesson plans serve a prospective teacher. Responses ranged from, "They make you thoughtfully decide what to teach and how to teach it so that it would be effective," to "They serve as a guide to the teacher so they can accomplish what they want, and do it in an organized fashion."

The process by which the research team categorized prospective teachers' responses followed the same stages as described above for practicing teachers to support coding reliability. After individually examining and categorizing teachers' responses, the entire research team reviewed and discussed each response and its categorization, re-classifying responses as needed. The percentage each category (i.e., theme) was indicated by prospective and practicing teachers is displayed in Figure 1.

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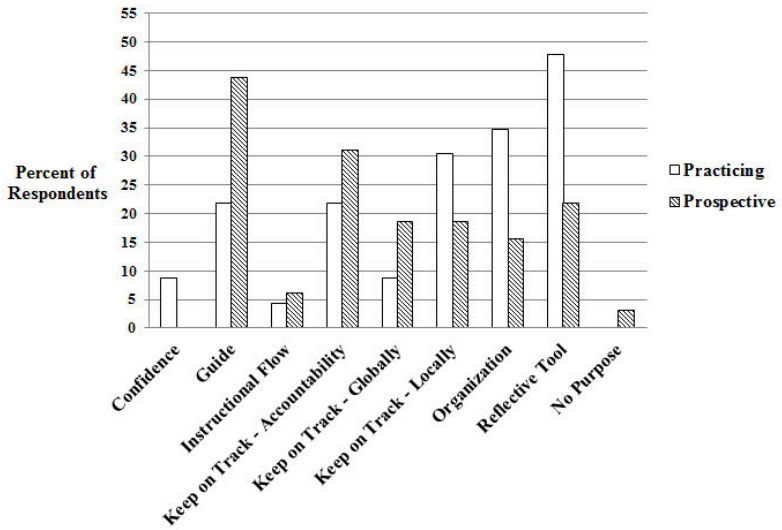

Figure 1: Practicing and Prospective Teachers' Responses to the Role that Formal Lesson Plans Serve Prospective Teachers

There were substantial differences between the percentages of practicing and prospective teachers' responses for "Reflective Tool," "Guide," and "Organization." Practicing teachers indicated formal lesson plans serve prospective teachers as a "Reflective Tool" 26% more and "Organization" 19.2% more than did prospective teachers. Taking into account that our sample of prospective teachers had been limited, in general, to observing K-12 instruction and tutoring individual students as part of their respective prior and current mathematics methods course field experiences, it is not surprising they would identify formal lesson plans as a "Reflective Tool" to a much smaller degree than practicing teachers. Regarding "Organization," practicing teachers used the term in the sense of helping a prospective teacher "prepare" or be "well planned" for a lesson. As observers or class tutors, our sample of prospective teachers would have limited understandings of how and what to prepare for pragmatically. Therefore, it seems reasonable that prospective teachers would indicate "Organization" to a much smaller degree than practicing teachers.

Prospective teachers identified "Guide" as a role formal lesson plans serve prospective teachers (i.e., themselves) 22% more than did practicing teachers. Prospective teachers used the term "Guide" in ways similar to how practicing teachers employed the term; that is, in very general ways. For example prospective teachers' responses included, "[It] will be a guide to help with my instruction"; whereas sample practicing teachers' responses, included, "[A] basic outline." Both groups of teachers used the term "Guide" in the sense described by Kagan and Tippins (1992), where a teacher simply "jot[s] down an outline or list of topics to be covered during the lesson, using a cryptic shorthand" (p. 478). Although our sample of practicing teachers may plan their lessons mentally, without committing much to paper as described by Kagan and Tippins (1992, p. 478) and suggested by their identification of a lessons plan as a "Reflective Tool," prospective teachers (especially at the mathematics methods stage) lack the experiences to think of lessons in terms of students developing understandings and skills, rather than in terms of topics.

The role of lesson plans for practicing teachers. Survey respondents were asked their perspectives on the role lesson plans serve practicing teachers. Practicing teachers indicated a wide range of perspectives regarding the role that formal lesson plans serve a practicing teacher (i.e., themselves). Sample responses included that lesson plans "help better organize the teacher and to keep track of what they taught or modified, and what is working and not working" to "I feel it is

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burdensome." Prospective teachers also indicated a wide array of perspectives regarding the role they envisioned formal lesson plans serving in their future as a practicing teacher. Responses ranged from, "They will help me improve my teaching by allowing me to look back at what I taught and fix my mistakes. It is a way to better my teaching," to "Formal lesson plans will be a requirement that I will do because it is required but not because it is valuable to me or my time."

Individual members of the research team examined and categorized teachers' responses using those categories (or themes), if possible, described earlier in Table 2. Next, the entire research team reviewed and discussed each response and its categorization, re-classifying responses as needed. These discussions again supported coding reliability. The percentage each category (i.e., theme) was indicated by prospective and practicing teachers is displayed in Figure 2.

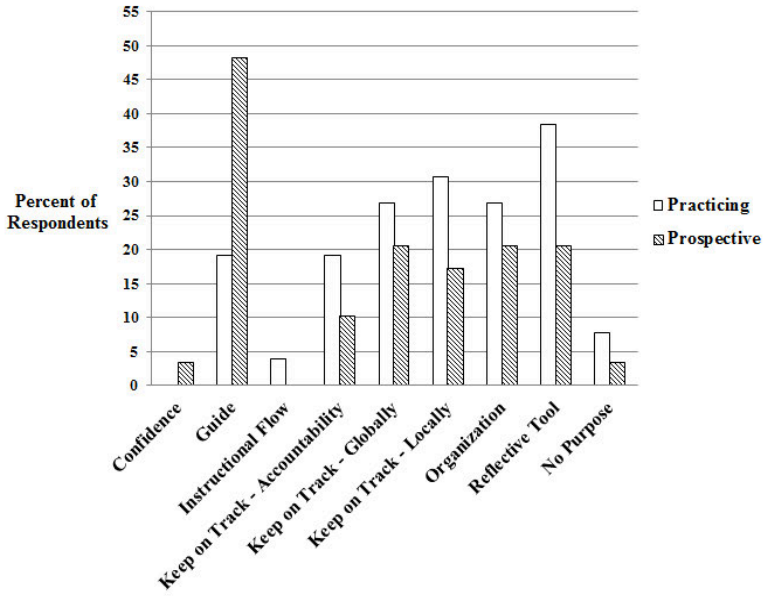

Figure 2: Practicing and Prospective Teachers' Responses to the Role that Formal Lesson Plans Serve Practicing Teachers

There were substantial differences between the percentages of practicing and prospective teachers' responses for "Guide" and "Reflective Tool." Prospective teachers indicated formal lesson plans serve practicing teachers as a "Guide" 29% more than did practicing teachers. As with teachers' responses to the role lesson plans serve prospective teachers discussed in the previous section, both groups of teachers used the term in very general ways, as an outline or list of topics to be covered during the lesson (Kagan & Tippins, 1992). Practicing teachers identified "Reflective Tool" as a role formal lesson plans serve practicing teachers (i.e., themselves) 17.8% more than did prospective teachers. As indicated in the previous section, such differences could be accounted for by prospective teachers' lack of experiences at designing and enacting instruction.

Discussion

In this report we described and compared prospective teachers' (at the mathematics methods stage of their respective licensure programs) perspectives of the role formal lesson plans can and do serve in mathematics teaching and learning with practicing teachers' perspectives. Analyses of teachers' responses to survey questions designed to make teachers' perspectives explicit indicated that our sample of prospective teachers had reasonable perceptions of district and school expectations they will encounter, regarding lesson plan requirements, as early career teachers—at least compared

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to our practicing teacher sample. In addition, we described how analyses suggest that lesson plan activities for prospective teachers at the mathematics methods stage should: (a) promote and reinforce a focus on student thinking and learning, rather than a focus on covering topics; (b) minimize the potential for interpretations that convey formal lesson plans as something done simply by mandate; and (c) model and engage teachers in authentic planning, enactment, and reflection sessions. Furthermore, analyses suggest that universities and licensure programs should seek consistency in their mathematics methods courses regarding: (a) resources faculty promote to their students (i.e., prospective teachers) and (b) the amount of time prospective teachers should anticipate spending developing and revising their lesson plans once they have entered the field.

Prospective teachers' inclination to view formal lesson plans as a "Guide" aligns with Kagan and Tippins (1992) suggestion that lesson plans be defined as a brief outline of instructional procedures to be used to supplement teachers' guides and other curricular materials and resources (p. 477, 488).Rather than pushing for lesson plans to be viewed as a "Reflective Tool" or a means to keep instruction "On Track," as identified by our sample of practicing teachers, mathematics methods instructors should allow for students (i.e., prospective teachers) to initially view lesson plans an outline or guideline. According to Kagan and Tippins (1992), once enacted, these lesson plans should be revised to reflect the "spontaneous modifications that occurred during class (p. 488)," thus becoming a record of interactions. Such a process has the potential to promote a more natural transformation of prospective teachers' perspectives of the utility of formal lesson plans toward student learning; thus, supporting prospective teachers' development of productive lesson images. It seems reasonable to expect prospective teachers' experiences at developing lesson plans, attempting to enact lesson plans, and reflecting on these attempts to vary somewhat across licensure programs and universities. The number and content of mathematics methods courses prospective teachers take, the amount and context of field experiences, and the faculty assigned to teach mathematics methods courses all have significant impact on these experiences. Results presented here do not address these distinctive experiences. Future research should explore how such potentially disparate experiences impact prospective teachers' expectations of the realities of mathematics teaching.

With a situative lens, a focus on teachers' perspectives regarding formal lesson plans supports the development of models of teachers' understandings and ways of thinking at two distinct points (i.e., contexts) along a teacher-learning trajectory: the mathematics methods stage, prior to student teaching, and the practicing teacher stage. Although each of these "stages" is idiosyncratic, with the practicing teacher stage itself encompassing a continuum of experiences and contexts, such a focus supports the development of productive learning-to-teach situations for prospective teachers. Such situations have the potential to be successfully re-contextualized in prospective teachers' future K-12 classrooms (Peressini et al., 2004, p. 70).

Finally, this study did not include one important set of data points, those of prospective teachers' perspectives during student teaching. As such, future research should explore teachers' perspectives on the role formal lesson plans serve at three distinct stages of a teacher-learning trajectory: prospective teachers enrolled in program-specific mathematics methods courses, prospective teachers during student teaching, and practicing teachers—including those teachers serving as cooperating or mentor teachers during student teaching.

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