Preservice Teachers' Use of Curricular Resources for Mathematics Lesson Design

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Received: 11 November 2018 Accepted: 22 March 2019

Curriculum resources are integral to teaching, yet more could be known about preservice teachers' curricular use when planning mathematics lessons. Framed with a consideration toward teachers' pedagogical design capacity, this study explores the decisions preservice teachers make when presented with four curricular resources and tasked with planning one lesson. Preservice teachers were pressed to provide rationale for their decision making around choice of resources. Findings indicate some resources were used much more extensively than others. The most common reasons cited were appropriate rigor and useful problems. Depending on the resource, the incorporation of manipulatives and real-world connections were also commonly cited.

Keywords · preservice teachers · lesson planning · curriculum · noticing · textbook

As teachers operate within a learning context, curriculum often serves as a mediating tool with which teachers interact to make instructional decisions that ultimately affect the learning outcomes of their students. Nicol and Crespo (2006) note textbooks, encompassed in the term *curriculum resources* for the purposes of this paper, provide a framework for considering the content that will be taught, who will be taught, when the teaching will occur, and how the teaching will take place. Researchers (e.g. Brown, 2009; Remillard, 2005; Sherin & Drake, 2009) have studied how teachers use curriculum resources, defined as "a tool that supports, guides, and enhances teachers' instructional designs, both in preparation for and during classroom interactions" (Remillard, 2013, p. 926). Much of this work has focused on practicing teachers' use of resources, with less emphasis on preservice teachers' interactions with resources. In a recent commentary specific to mathematics education, Taylor (2016) argued that understanding effective curriculum use includes recognising and knowing how preservice teachers use curricular resources. For the purpose of this paper, the focus is on the use of curriculum specific to mathematics. Within the context of mathematics teaching and learning, knowledge of the trajectory of novice to expert curricular use would support teacher educators to have a clearer understanding of the professional development or teacher education coursework necessary to support mathematics teachers to learn effective uses of curriculum. Further, preservice teachers, who are often uninitiated to the use of curricular resources (Drake, Land, & Tyminski, 2014), represent one end of the spectrum of such a trajectory, thus illuminating the importance of understanding their curriculum-use practices.

The study of curriculum use extends beyond knowing the tools and outcomes of particular use. Choppin, McDuffie, Drake and Davis (2015) extend the notion of curriculum with a stronger emphasis on the human action and cognition that occurs when teachers interact with resources. They consider curriculum to "be thought of as a text that primarily serves as a generator of interactions or as a conduit to transmit information or knowledge" (p. 67). Similar to Choppin et al. (2015) and Remillard (2005) the perspective in this paper situates the teacher as an active agent, interacting with the resources and using materials to various extents. In this process of interaction, the teacher's knowledge and experiences often influence exchanges with resources. For example, Lui and Bonner (2016) compared instructional planning of practicing and preservice teachers and found a relationship between conceptual understanding and constructivist perspectives, noting that adapting curriculum resources is related to mathematics teachers' knowledge and understanding. In a study more centrally focused on interactions with curriculum resources, Land, Tyminski, and Drake (2015) note preservice teachers' curricular decisions are commonly based on their prior experiences coupled with current knowledge. Further, these researchers (Drake et al., 2014; Land et al., 2015) have explored how preservice teachers read, interact, and evaluate curriculum resources, which highlights the importance of understanding more specifically how preservice teachers use and adapt materials.

Recognising the importance of further understanding how preservice teachers read and interact with resources, this paper focuses on how preservice teachers make curricular decisions about what to include in a lesson plan and emphasises the rationale behind said decisions. In the context of the present study—preservice teacher education in the United States—many preservice teachers engage with print materials that constitute a textbook for students and accompanying teacher pages. On this basis, this study focuses specifically on these documents to address the following research questions:

1. When presented with multiple printed lessons from textbooks and tasked with planning a lesson, what components from the materials do preservice teachers use when planning lessons?
2. What do preservice teachers cite as their rationale for decisions around specific textbook use?

Theoretical Framing

This study is theoretically framed from the perspective of a teacher-tool relationship, specifically *pedagogical design capacity* (Brown, 2009). Brown (2009) considers teaching as a design activity in which a teacher interacts with the resources with which he or she uses, based on that teacher's perceptions and interpretations. As this occurs, the teacher's ability to mobilise resources for instructional purposes affects the decision outcomes as the teacher either: a) offloads, b) adapts, or c) improvises, based on curricular materials. "These three types of use characterise different ways in which teachers appropriate curriculum resources within their designs, resulting in differential distributions of agency for guiding instruction" (Brown, 2009, p. 25). Brown (2009) defines *offloading* as using the materials literally, *adapting* as adding or subtracting resources and altering the content or learning objectives, and *improvising* as having minimal reliance on materials and devising one's own strategies for implementation. Consequently, the paper is theoretically framed with pedagogical design capacity based on the

teacher's use of the materials, termed artefact appropriation, and with realization that this capacity encompasses "a teacher's skill in perceiving affordances, making decisions, and following through on plans" that are presented in materials (p. 29). Specifically, the analysis and consideration of use focuses on the extent to which lesson components are offloaded, adapted, or improvised and the reasons for these decisions.

Related Literature

Mindful of supporting novice educators' curriculum use, Taylor (2013) raised the question, "What does a 'trajectory of effective curriculum use' look like, and how can teacher preparation and professional development support advancement along it?" (p. 314). In this case, trajectory means the teacher's learning path for using and implementing curriculum resources. Before considering how teacher education, or support for novice educators, may link with curriculum use, it is important to understand how teachers use resources. Remillard (2005) described curriculum use among practicing teachers, noting the relationships between the teachers' characteristics and the curriculum resources. She identified four key assumptions and accompanying theoretical perspectives influencing conceptions of curriculum use: following or subverting, drawing on, interpreting, and participating with; these are somewhat related to Brown's (2009) degrees of artefact appropriation, offloading, adapting, improvising. Considering the idea of modifying materials, Sherin and Drake (2009) sought to identify strategies elementary teachers used as they interacted with reform-based resources. They noted that much of the research work on curriculum use has emphasised the prevalence of adapting resources, meaning teachers often modify resources by adding to them, omitting sections, or replacing components (e.g. Brown & Edelson, 2003; Remillard, 2005; Remillard & Bryans, 2004), again, similar to the theoretical underpinnings of this present study. However, few studies have focused on how these decisions are actually being made and the rationale for these decisions. Sherin and Drake (2009) recognise, "that in order to fully understand the teachers' role in the implementation of reform, greater understanding is needed of the interactions between teachers and the curriculum resources they use" (p. 491); this is especially true with respect to preservice teachers.

Similar to Sherin and Drake (2009), Behm and Lloyd (2009) also focused on curriculum use but centred their research on preservice teachers to further understand how this specific population was interacting with curriculum resources. Findings indicated variations in curriculum use persist among preservice teachers, just as with practicing teacherswith some preservice teachers adhering closely to curriculum resources, others adapting significant components within resources, and others selecting to use resources minimally, if at all (Behm & Lloyd, 2009). Recognising the preservice teachers' experiences during teacher preparation programs influences their relationship with resources as they progress through their careers, Behm and Lloyd (2009) called for a closer examination of how teachers across the experience continuum use resources, which includes a call to further analyse and understand how preservice teachers interact with resources.

In mathematics education, authors of research spanning decades claim preservice teachers commonly equate effective teaching with limited reliance on curriculum resources (Feiman-Nemser, 1988; Nicol & Crespo, 2006). Aware of this perception, Nicol and Crespo (2006) examined how elementary preservice teachers "interpret, use, and possibly learn from

curriculum resources in the context of a teacher education program" (p. 332). These researchers engaged in a cross-case analysis to understand preservice teachers' perceptions of curriculum resources, how they used curriculum resources, how they planned to use resources in their teaching, and how they used resources in their practice of teaching. Of notable interest, when preservice teachers were asked to select problems they would teach, all problems selected were those they considered would be relatable for students (many of these were in familiar contexts for students). Additionally, of the tasks selected, not all were rich learning tasks: some were procedural, raising questions about the rationale behind preservice teachers' decision making when selecting curriculum resources (Nicol & Crespo, 2006). This study brought forth questions about not only how preservice teachers use given materials, but how they may select from multiple available resources—a reality given the relative ubiquity of print and digital resources.

Curricular Availability

When faced with curriculum resources, both practicing teachers and preservice teachers are forced to make decisions about what resources to use, how to use the resources, and the ensuing learning outcomes, tasks, or activities. Further, with new technologies and increased access, teachers are faced with many resources, ranging from district adopted curriculum resources, to supplemental resources. These include vetted online resources and open source resources that may or may not be pedagogically or mathematically coherent (Choppin et al., 2015). "In many cases, new digital materials have intensified features that follow the delivery metaphor" meaning the goal of the resources is to transmit knowledge as opposed to provoking interactions to generate understanding (Choppin et al., 2015, p. 70). This influx of resources can be overwhelming for preservice teachers, who have yet to fully understand or implement such resources in instructional settings; however, this reality is worth studying because of the likelihood of encountering numerous resources. Likewise, preservice teachers may never have taught using curriculum—even traditional printed textbooks—and may lack authentic experiences implementing resources, which influences their curriculum use (Behm & Lloyd, 2009; Remillard & Bryans, 2004). Therefore, although many types of resources exist, including print and digital, proprietary and open source, it is important to understand how preservice teachers would interact when faced with the materials that are commonly presented in the classrooms they will enter—in the present case with the context of this study, this means print textbooks and the accompanying teacher materials.

Content Domains

Recalling Taylor's (2013) aforementioned question about the trajectory of effective curriculum use and the call to know more about preservice teachers' curricular interactions, begs the question about mathematics content and differences in how preservice teachers may approach various content domains within mathematics when planning lessons using a variety of materials. Of the various domains within mathematics, studying, understanding, and teaching fractions is one that is notoriously difficult for novice educators (Lamon, 2007). Fractional content is often difficult for students and is similarly difficult to teach (Charalambos & Pitta-Pantazi, 2007). Many researchers consider the multifaceted subconstructs of fractions (i.e. part-whole, ratio, operator, quotient, and measure) to contribute to this difficulty. As a result of the difficulty of fraction content for learning and teaching, and given the call for further research on curriculum use, it

was necessary to study and understand differences in how preservice teachers use textbook materials as they make decisions about instruction.

Ultimately, the goal of the study is to understand how preservice teachers make curricular use decisions when using textbook materials and accompanying teacher resources—specifically, materials from four different publishers. The idea is to understand the decision-making process and reasons for the decisions, in a situation that emulates practice, so that teacher educators can better support preservice teachers as they learn to use materials. Part of the intent is to understand to what extent, meaning how much or how little, the resources are being used, which is in accordance with the framing of pedagogical design capacity and idea of recognising whether teachers are offloading, adapting, or improvising materials (Brown, 2009). The ultimate goal is to support preservice teachers in effectively using resources and in being effective teachers; therefore, it is first important to know how they use materials.

Method

Cognizant of the theoretical framing of pedagogical design capacity (Brown, 2009) and an understanding of the degree of artefact appropriation (offloading, adapting, improvising), the following includes the description of context and participants, data collected, and qualitative data analysis to describe the preservice teachers' use of the materials.

Context

The study took place over a three-year span at a doctoral granting research university in the Western United States. Participants in the study were enrolled in an elementary teacher education program seeking state licensure in grades K-8. At the time of data collection, participants were taking a block of methods courses, including a mathematics methods course (focus of this study), a science methods course, a social studies methods course, and a practicum course for all three subjects. The intent of the methods course was to teach pedagogical aspects related to specific content areas. Additionally, the preservice teachers were each placed in a different K-8 classroom for their practicum, which resulted in different learning opportunities for each participant with respect to using mathematics curriculum. For the practicum placements, also known as field experiences, the preservice teachers were in classrooms in a school district that did not have a specific curricular resource prescribed for mathematics. The most recent resource had been adopted more than fifteen years prior to this study and was used sporadically; some teachers still used the resource, but there was no district requirement regarding resources, so the participants' preparation and curricular use varied immensely.

Methods course and Participants

Data were collected within the mathematics methods course for three consecutive years, which was taught once annually, each Autumn semester. Participants in the study included all enrolled preservice teachers in the three sections of the course, totalling 50 preservice teachers (Autumn 2013, n= 18; Autumn 2014, n = 17; Autumn 2015, n=15). All participants agreed their work could be analysed for research purposes and all signed informed consent forms in adherence with approved ethical research processes. The same instructor taught the course for all three years

and is the author of this paper. The course was based on the Van de Walle, Karp, and Bay-Williams (2012) text, with an emphasis on the three-part lesson design: launch, investigate, summarise. One three-hour class session was devoted specifically to lesson planning following this format and course sessions throughout the semester centred on designing and implementing a three-part lesson. Specific attention was called to the decisions preservice teachers would have to make in planning lessons, in that many curricula are not presented in the three-part format. Each student in the course worked with the instructor from weeks six to twelve of the semester to design and implement a mathematics lesson on his or her practicum placement. Preservice teachers were provided feedback on these lessons plans from: a) peers, b) the course instructor, c) a practicum supervisor, and d) the host classroom teacher in which the lesson would be taught. Preservice teachers used the curriculum that the particular teacher in his or her practicum setting was using, again emphasising that the district where these students were placed for their practicum had no formally-adopted curriculum at the time. Other interactions with curriculum within the methods course were minimal.

Data Collected

Data for this study included written documentation stemming from completion of a task—one written lesson plan for a sixth-grade lesson on division of fractions (for task, see Appendix A). The task was designed with the intent to emulate a lesson planning scenario where teachers are often faced with multiple resources (Choy, 2016; Land et al., 2015) and are positioned to make decisions about the curricular elements they will incorporate in their lesson. To design the task, a sixth-grade standard on the division of fractions was selected: 6.NS.A.1 *Apply and extend previous understandings of multiplication and division to divide fractions by fractions* (Common Core State Standards Initiative (CCSSM), 2010). Then, the four curricula series most commonly used in the geographical region where the study took place were reviewed to find the lesson most closely aligned with this standard. These were selected specifically because they were most likely to be the materials the preservice teachers would use when they assumed their first teaching position. A second researcher was consulted to confirm the decisions about alignment between resources and the standards. Each of the four lessons provided to the preservice teachers came from one of each of the following resources: *College Preparatory Mathematics* (Kysh, Dietiker, Sallee, Hamada, & Hoey, 2013), *enVisionMATH* (enVision, 2011), *Everyday Mathematics* (Everyday Mathematics, 2010), and *Saxon Math* (Saxon, 2010). For the duration of the study, these extracted components from the resources are referenced as lessons and the components within lessons.

According to publisher information, *College Preparatory Mathematics* is described as a non-profit educational consortium that began as a grant-funded mathematics project to write textbooks. Decisions about resource contents are based on recommendations of the National Council of Teachers of Mathematics and structured around research-based principles. *enVisionMATH*, published by Pearson, is described as providing daily problem-based interactive math alongside visual learning strategies to develop conceptual understanding by supporting students to form connections. *Everyday Mathematics* is described as a comprehensive curricular program for grades Pre-K through Grade 6 mathematics. *Everyday Mathematics* is research-based and field-tested; resources were developed by the University of Chicago School Mathematics Project and published by McGraw-Hill Education. *Saxon Math* is described as

incorporating an incremental structure of distributed content throughout the year through an integrated and connected approach that supports long-term mastery of content and skills. All four versions of the resources were those printed in or immediately before 2010, prior to the inclusion of resource changes based on the implementation of the Common Core State Standards in the United States (CCSSM, 2010). Specific lessons reviewed and then incorporated into the task included: *College Preparatory Math*, Grade 6, Lesson 6.1.4, How does it make sense? (p. 548-557), *Everyday Mathematics*, Grade 6, Lesson 6-2, Division of Fractions and Mixed Numbers (p. 537-541), *enVisionMath*, Grade 6, Lesson 9-3, Dividing Fractions (p. 206A-207B), and *Saxon Mathematics*, Grade 6, Lesson 68, Dividing Mixed Numbers (p. 349A-352). From this point forward, the following abbreviations are used to refer to these resources: *CPM*, *Everyday*, *enVision*, and *Saxon*. Table 1 includes a brief review of the content of the four lessons.

Table 1
Overview of Lessons

Material	Objective; Lesson Contents
CPM	Division of Fractions by Fractions; the concept of dividing fractions by fractions is used within the context of reading music and the creation of a doll house using wooden boards. Several problems are presented for students.
Everyday	Algorithm for Division of Fractions; the lesson includes the first section, "Teaching the Lesson", in which students divide a whole number by a fraction, as related to measurement. This is followed by a section on introducing the division of fractions, in which the procedure of "invert and multiply" is specifically taught and students have a worksheet page in which they practice the procedure. The end of the lesson includes a section on "Dividing Fractions and Mixed Numbers" in which the materials direct teachers to focus on the "invert and multiply" procedure. Students then take part in "Ongoing Learning" and practice with review problems. Differentiation options are included for "enrichment" and "extra practice".
enVision	Multiplication to Divide Fractions; the lesson begins with a "Daily Spiral Review" and moves to an "Interactive Learning" section in which students are to use paper strips as a model to divide a fraction by a fraction. Students are then presented with a volume problem in which a fractionally-full container of lemonade is partitioned into fractional amounts. The materials included a "Guided Practice" section, followed by an "Independent Practice" section. A "Problem Solving" section then follows in which students solve several problems. The lesson concludes with a "Closure Section" that includes content for assessment and differentiation.
Saxon	Divide a mixed number by a whole number; the lesson begins with a "Power-Up Discussion" that focuses on "Problem-Solving Strategies" and encourages students to "Use Logical Reasoning." The lesson then moves to include a "New Concept" in which fractional amounts of liquid are used as an example, with a focus on using reciprocals. There is a section for fact practice in which students

	"write each improper fraction as a mixed number. Reduce fractions." Examples of fractional division are included and students are to engage in "Written Practice" that includes a mix of new learning and prior learnings. The "Written Practice" includes a "Math Conversation" section that includes questions the teacher can ask for certain problems. The lesson concludes with a section on "Looking Forward" to other related lessons.

The lessons provided to participants were one component of the larger resources embodied with the published curriculum. For additional information on each individual lesson provided, see Appendix B.

All participants were given three hours to work independently on the task, which was part of the course. The task was administered during the last week of the sixteen-week course. Upon arrival to the data collection setting, participants had been informed they should be prepared to apply the knowledge learned from the semester to formulate a lesson plan; they were not aware of the grade level or topic of the task. Participants were each supplied with the Standards for Mathematical Practice (CCSSM, 2010) and the lesson standard, 6.NS.A.1 *Apply and extend previous understandings of multiplication and division to divide fractions by fractions* (CCSSM, 2010). They also had access to each of the aforementioned curricular lessons. They did not have access to online resources, books, or other support resources. The purpose was to isolate their focus to gain an understanding of where they focused their attention and how they interpreted resources.

As evidenced in the template (Appendix A), the preservice teachers were asked to write the lesson plan, but were also asked for their rationale for decisions. The template format was familiar to the preservice teachers, as they had used the same template throughout the semester for their lesson planning in the mathematics methods course and for their practicum placement. This template was also used across all the disciplines in the education program. Given their experience with the template, this may have influenced their lesson design. The only difference between the template (Appendix A) and the preservice teachers' typical lesson planning expectations was the follow-up questions at the end asking about curriculum resources used, not used, and rationale.

All preservice teachers in all three course sections submitted the written lesson plan and responses to the accompanying questions about their curriculum use. During implementation, the mean time for completion was approximately two hours and thirty minutes for planning the one lesson. The preservice teacher who completed the task in the least amount of time took one hour and five minutes and five out of the fifty participants had difficulty finishing within the three-hour time limit.

Data Analysis

Data were analysed in two phases, beginning with a more comprehensive perspective in Phase One and narrowing more specifically in Phase Two. Phase One analysis focused more broadly on the decisions about using resources at the lesson level. Phase Two analysis was more nuanced, focusing specifically on decisions made at the curricular element level.

Phase One

Phase One analysis was intended to capture the extent to which the participants decided to include components from the various curricula at the lesson level. This analysis centred on the four reflection questions participants completed as they were finalising their lesson plan:

1. What resource(s) did you use the most? Why?
2. What about these resources led to your decision to use them?
3. What resource(s) did you use the least? Why?
4. What about these resources led to your decision not to use them, or to use them less?

The responses were also coordinated with the degrees of artefact appropriation (i.e. offloading, adapting, improvising) (Brown, 2009). Given that the study incorporated four resources, there was some ambiguity with aligning pedagogical design capacity with the use or non-use of resources, but this perspective provided a framing for analysing the curricular use. Therefore, for each participant, responses to these questions were read in entirety and collectively assigned a code relating to use (See Table 2). To arrive at these codes, two researchers initially coded a subset of the data to better understand how preservice teachers were describing their use of curriculum resources. Recognising that preservice teachers were referring to the curriculum resources by name and commonly describing their use and purpose by name, the present framework was created to capture preservice teachers' described uses of resources. After the framework was created, the researchers independently coded a different subset of the data and compared codes with 90% agreement. Following this, the remaining data items were coded independently by each of the researchers. Across the entire data set, interrater agreement was 88%. The two researchers met and reached consensus on all discrepancies in the data, resulting in complete agreement. There is a difference between the descriptors mentioned and the closest degree of artefact appropriation, as defined by Brown (2009); however, both represent a continuum of use and can be considered similarly at the level of the resource.

Table 2
Curricular Use Coding Framework

Code	Descriptor	Closest Degree of Artefact Appropriation at the resource level (Brown, 2009)
Level 4	Curricular resource mentioned and used exclusively	Offloading
Level 3	Curricular resource mentioned and used as a main resource	Offloading/Adapting
Level 2	Curricular resource mentioned and used, but not as primary resource(s)	Adapting
Level 1	Curricular resource mentioned, but not used	Improvising
Level 0	Curricular resource not mentioned	

Phase Two

Following the Phase One analysis, the intent was to understand the rationale behind the decisions for use—in other words, what had the preservice teachers noticed from the resources that led to their use of specific resources? More specifically, a focus was on the rationale about the curricula that each preservice teacher relied on to the greatest extent to better understand why that resource was preferred above the rest. As a result, the same two researchers identified the curricular resource with the highest code for each participant from Phase One. In the case of seemingly equivalent use, all curricula with the highest number for a given participant were considered a primary resource. For example, if a preservice teacher had the following Phase One codes: *CPM* (Level 1), *enVision* (Level 3), *Everyday* (Level 2), *Saxon* (Level 1), the focus for the Phase Two analysis was on the rationale for their use of *enVision*. Or, as another example, if a preservice teacher had the following codes: *CPM* (Level 2), *enVision* (Level 2), *Everyday* (Level 1), *Saxon* (Level 2), then the Phase Two analysis focused on all three of the Level 2 resources (*CPM*, *enVision*, and *Saxon*) because that was the highest code. After identifying the most heavily used resource for each participant, the same two researchers reviewed the rationale in the lesson plan (far right column, Appendix A) (i.e. What is your rationale for EACH part of this investigation? Why did you include the components you included? Be SPECIFIC.) and the rationale provided in the reflection question responses. To create a framework for this analysis, both researchers initially open coded a subset of 10% of the data using constant comparative methods (Corbin & Straus, 2008). They then met and compared codes resulting in the Curricular Use Rationale Codebook (Figure 1). The Curricular Use Rationale Codebook contains all open codes (lettered) and four overarching themes that were evident (i.e. Beliefs/Values, Format and General Content, Mathematical Content, and Practices). Following this, the two researchers who had completed the Phase One analysis then analysed all rationale data and assigned each participant codes for rationale. The two researchers then met to reconcile differences in codes. Inner rater reliability exceeded 90% and all discrepancies in data were negotiated until the two researchers came to a consensus on the code.

Beliefs/Values

A. Conception of Lesson/Closest to teaching preference or personal experience
B. Alignment with Philosophical Beliefs

Format and General Content

C. Clearly Presented/Readable/Time Saving
D. Familiarity
E. Alignment with Standards
F. Educative
G. Lesson Structure

Mathematical Content

H. Conceptual approach for students/Supports students' understanding
I. Focus on process to answer/procedural fluency
J. Appropriate Rigor/Useful Problems

Practices

K. Appropriate questions/methods of gaining student input
L. Visuals/Manipulatives
M. Appropriate Models
N. Engaging/Fun/Creative
O. Accessibility (e.g. multiple entry points with tasks)
P. Real-world Connections/Contextual Connections

Figure 1. Curricular Use Rationale Framework

Findings

The following describes the findings in detail, beginning with an overview of the resources the preservice teachers used as they planned their lessons. The section then includes a review of the rationale the preservice teachers provided for their decisions around curricular use. Collectively, these two sections provide information on the curricular use of the preservice teachers by foregrounding their use of various curriculum resources and illuminating their reasons for said decisions.

Resource Selection

To consider the resources preservice teachers use as they make decisions about responding, or planning a lesson in the case of the current study, the focus was initially on the degree to which each resource was used. One level (Level 0-4) was designated for the use of each curricular resource for each preservice teacher, based on the Curricular Use Coding Framework. As evidenced in Table 3, *CPM* was most commonly referenced as a Level 1 resource, meaning preservice teachers read the resource, but did not use the resource. In contrast, *enVision* was commonly used, and 30% (n=15) used *enVision* exclusively, as denoted in Level 4 data. This is in sharp contrast to exclusive use of *CPM* (n=3), *Everyday* (n=1), or *Saxon* (n=2). Similar to *CPM*, *Everyday* elements were also most commonly read but not incorporated into the lesson design. Similar findings were true for *Saxon*.

Table 3
Number of Participants for each level of use for each resource (Note: Everyone was given one level (0-4) for each resource; this shows the number of participants at each level) n=50

	CPM		*enVision*		*Everyday*		*Saxon*	
Level 4	3	(6 %)	15	(30 %)	1	(2 %)	2	(4%)
Level 3	5	(10 %)	12	(24 %)	10	(20 %)	5	(10 %)
Level 2	4	(8	9	(18	6	(12	3	(6%

		%)		%)		%)		)
Level 1	30	(60 %)	8	(16 %)	24	(48 %)	29	(58 %)
Level 0	8	(16 %)	6	(12 %)	9	(18 %)	11	(22 %)

The overwhelming preference and use of *enVision* as compared to the other resources, and the higher levels of use of that resource when not the main source, raised questions about the primary resource used in the design of the lesson plans. In other words, if preservice teachers used multiple resources, which resources were the primary sources?

As noted in the description of the data analysis, there were instances when preservice teachers equally—or seemingly equally—used two or more (n= 14) resources as a primary resource. Likewise, there were cases when the preservice teachers did not use any resources and were explicit about their lack of use (n=6). Table 4 provides descriptive data of the number of primary resources used by the preservice teachers. Note that each preservice teacher was only counted once in this table, dependent on the number of primary resources.

Table 4

Number of resources as primary used by number of preservice teachers (n=50)

Number of Resources Used as Primary	Number of Preservice Teachers
0	6
1	30
2	12
3	2
4	0

Note: The 30 participants who used *enVision* as a primary resource) are not necessarily the same 30 participants who used only one primary resource in Table 6. This does not reflect data from preservice teachers who did not use any of these resources (n=6); some participants used more than one primary resource, which is reflected here. The total of 50 in Table 4 should not be equated to the total number of participants (n=50), but is instead instances of primary resource use.

Table 5 shows the distribution of curriculum used as a primary resource.

Table 5

Number of preservice teachers who used the resource as the primary resource

CPM	enVision	Everyday	Saxon
9	30	13	8

Of the 44 using resources, 18% percent of preservice teachers used *CPM* as the primary resource, 60% used *enVision*, 26% *Everyday*, 16% *Saxon*, and 12% did not use a primary

resource. (Again, recall that a single participant could have more than one primary resource.) *Everyday* was the second most commonly used primary resource and was often a complement use of *enVision*.

Additionally, recall there were six who did not use any curricular resource and of the 44 using references, they did not all reference reading all four resources. Table 6 shows the number of preservice teachers who did not read or did not mention a specific resource; it is possible that resources were read and not mentioned.

Table 6
Number of preservice teachers who did not read or mention particular resources

CPM	*enVision*	*Everyday*	*Saxon*
8	6	9	11

Note: As an example, 8 of the 50 preservice teachers made no indication that they read *CPM*. These 8 could have mentioned or used another resource.

Together, these findings indicate that the preservice teachers were more likely to use *enVision* and they used these resources at higher levels (see Table 2) than the other resources.

Use Within Specific Resources

To better describe preservice teachers' use of various resources, the following focuses on each of the four lessons from the resources, in no specific order, and highlights the main themes for the preservice teachers' rationale specific to those resources—again based on the Curricular Use Rationale Framework. To determine the themes, data for the preservice teachers were sorted based on the curricular resource that was the primary use. Then, the frequency counts for each theme were tabulated and considered. Next, the percentage of preservice teachers that explicitly mentioned a given reason for the decision was calculated. Table 7 shows the main themes for each of the four lessons and the following sections explores these themes as they relate to the specific resources. Caution is noted in that the participant numbers are low and the percentages may simply provide a glimpse of what the preservice teachers valued in their rationale.

As evidenced in the table, the main reasons noted for using *CPM*, or the elements that were valued, were: (1) conceptual approach for students/supports students' understanding, (2) appropriate rigor /useful problems, and (3) appropriate questions/methods of gaining student input. The main reasons noted for using *enVision* are (1) appropriate rigor/useful problems, (2) visuals/manipulatives, (3) engaging/fun/creative, and (4) real-world connections/contextual connections. For *Everyday*, the most referenced rationale reasons included: (1) lesson structure, (2) conceptual approach for students/supports students' understanding, and (3) appropriate rigor/useful problems. Finally, for *Saxon*, the most cited reasons included: (1) conception of lesson/closest to teaching preference or personal experience, (2) lesson structure, and (3) appropriate questions/methods of gaining student input.

A close analysis of Table 7 reveals some interesting trends with respect to preservice teachers' rationale for using, or valuing, specific lesson elements. Recall that the percentages listed in the table are the percentage of preservice teachers who used that specific resource as the primary resource and explicitly mentioned the given theme. Analysis of the use of *enVision* indicates that the percentages across the various themes are high relative to the other resources,

meaning that those who used *enVision* as a primary resource had numerous reasons cited for their use of that resource. In fact, of the 30 preservice teachers who used *enVision* as a primary resource, *all* 30 referred to the visuals or manipulatives as a reason for using the resource. Similarly high, 97% of the preservice teachers who used *enVision* as a primary resource also mentioned appropriate rigor/useful problems and real-world connections/contextual connections. Of increasing interest are the percent of preservice teachers citing real-world connections/contextual connections because of the drastic difference in citing that reason. As stated, 97% of *enVision* users referenced real-world connections/contextual connections as compared to 0% for *CPM*, 38% for *Everyday*, and 25% for *Saxon* primary users. This high percentage for rationale for the *enVision* resource indicates that preservice teachers were likely seeking resources that made connections or had contextual support for students. Another interesting data point is the high percentage of those who cited conception of lesson/closest to teaching preference or personal experience as their rationale for using *Saxon*. Seventy-five percent of those who primarily used *Saxon* referenced their experiences and alignment between the content of *Saxon* and how they thought the lesson should be taught.

Table 7 indicates that preservice teachers selected various resources as their primary resource for varying reasons. The number of reasons mentioned was typically higher for those who used *enVision* as a primary resource, which may indicate a greater extent of resource interaction for those lessons—meaning the preservice teachers likely attended to more elements in *enVision* than other resources because they referenced more of them. That being said, it is possible to have attended to curricular elements and then made the decision to not include them and not reference them in the written plan. Nevertheless, a very high percentage of preservice teachers selected to use *enVision* as a primary resource and did so on the basis of useful problems, appropriate questions, engaging features, and real-world connections—arguably features with which they found value for instruction.

Finally, beyond data expressed in Table 7, there were six preservice teachers who indicated they did not use any resource as a primary resource, meaning they could have read the lessons, but did not include components of any resource in their lesson plan. One preservice teacher's comment was representative of these comments, "I did not use the resources much. Some I felt were too complex and wordy. I primarily used what I have seen in my practicum classroom and what we have discussed in [mathematics methods] class." Of the six who selected to not incorporate any specific curricular elements from the resources, the majority commented on their use of the standards. For example, "I used the Mathematics/Standards for Mathematical Practices the most. I was able to make my own lesson, while hitting target points." In this group of six, it was typical that they mentioned self-creating the lesson based on their own ideas and experiences.

Table 7
Percentage of preservice teachers within each resource who explicitly mentioned each theme.

	CPM (n=9)	enVision (n=30)	Everyday (n=13)	Saxon (n=8)
A. Conception of Lesson/Closest to teaching preference or personal experience	22%	59%	31%	75%
B. Alignment with Philosophical Beliefs	44%	10%	15%	13%
C. Clearly Presented/Readable/Time Saving	11%	62%	46%	50%
D. Familiarity	11%	21%	8%	0%
E. Alignment with Standards	11%	31%	31%	13%
F. Educative	22%	41%	31%	25%
G. Lesson Structure	44%	76%	85%	75%
H. Conceptual approach for students/Supports students' understanding	78%	79%	62%	38%
I. Focus on process to answer/procedural fluency	22%	45%	23%	50%
J. Appropriate Rigor/Useful Problems	56%	97%	77%	75%
K. Appropriate questions/methods of gaining student input	67%	72%	46%	50%
L. Visuals/Manipulatives	33%	100%	38%	38%
M. Appropriate Models	33%	83%	8%	13%
N. Engaging/Fun/Creative	44%	93%	31%	50%
O. Accessibility (e.g. multiple entry points with tasks)	0%	83%	38%	13%
P. Real-world Connections/Contextual Connections	0%	97%	38%	25%

Resource Use Rationale

Recognising the resources used the most and least, and knowing that preservice teachers used different resources to varying degrees, the following broadly explores the reasons for curricular use and then focuses specifically on the elements of resources preservice teachers cited as their rationale for use. The intent is to better describe the preservice teachers' curricular use—specifically, those elements to which they attended and subsequently cited, or valued, as rationale for their decisions.

Based on frequency counts across the data set using the Curricular Use Rationale Codebook (Figure 1), there were two main primary reasons cited for selecting to use specific resources: (a) Lesson Structure and (b) Appropriate Rigor/Useful Problems. There were four additional themes that were also commonly referenced: (c) Conception of Lesson/Closest to Teaching Preference or Personal Experience, (d) Clearly Presented/Readable/Time Saving, (e) Conceptual Approach for Students/ Supports Students' Understanding, and (f) Visuals/Manipulatives. The following explores these themes to provide an understanding about preservice teachers' curricular use decisions.

Primary reasons. The two main reasons cited for resource use are categorised under Format and General Content and Mathematical Content, based on the analysis framework (Figure 1). The following describes each of these primary reasons.

Lesson structure. As the preservice teachers reviewed the resources, they were aware of the structure of the resources, meaning the contents and the sequential organization of those contents as they related to students' mathematical understanding. In commenting on his selection of a particular resource, one preservice teacher wrote, "These resources [I used in my plan] had good problems that were laid out in chronological order (how I would teach them). They also had clear purposes stated that I really liked." In this case, the preservice teacher referenced the chronology of the elements as referenced in the resources and considered this order to align with his pedagogical preferences.

Another preservice teacher thought similarly and focused on the progression of the lesson, as written in the resources, "This lesson made more sense to me than the others. I like the way it progressed through the content and the example that was used." This idea of the content at the beginning of a lesson and then the progression to the subsequent material was a common theme among preservice teachers. Another noted, "I used *Everyday* the most. I thought the lesson had the best introduction exercise and it matched the standard closely. I like how it started with basic concepts before introducing the meat of the lesson." In this example, the preservice teacher considered the structure by focusing on the order in which the mathematics content was presented. Across the data set, lesson structure was a primary reason for resource selection among the preservice teachers.

Appropriate rigor/useful problems. In addition to heavy reliance on the lesson structure, preservice teachers were also focused on noticing the appropriateness and usefulness of problems. When asked what resources were used the most and why, one preservice teacher considered the problems with the resources and noted:

> *CPM* – They had great modelling. For example, with (examples) 6-44 and 6-45, they showed with pictures how to solve the problem. This curriculum also had great questions. I really like how the questions led us through 6-44. This curriculum did not jump right to multiplying by the inverse. Instead it explained what happens when we divide by fractions.

When the same preservice teacher responded about what led to the use of resources referenced, she noted, "Their use of models. The questions that they used. The types of problems presented," which indicated she noticed the appropriateness of the problems included.

Similarly, another preservice teacher considered what she had learned and recognised the value of providing challenging mathematical tasks to students:

> I used materials from College Preparatory Mathematics, Grade 6, because I wanted the students to figure out the how to solve and divide fractions. I have learned through the semester that it is through challenging students in meaningful problems they can grow in their understanding of their math concepts. It is also through sharing these understandings that students build upon prior knowledge. In the CPM lesson the lesson emphasised solving a problem with a group and then discussing it with the class. As the teacher, I just didn't want to throw an algorithm at them, but I wanted them to figure out how to build an algorithm strategy for solving an equation.

In this excerpt, the preservice teacher focused on elements that would challenge students and present them with "meaningful problems." She recognised the relationship between the tasks presented and student learning and focused on centring her lesson on such tasks. This theme of making decisions based on preservice teachers' interpretations of appropriate rigor of resources and useful problems was common among the preservice teachers.

Secondary Reasons. In addition to lesson structure and appropriateness and rigor of problems, four additional themes were prevalent in the preservice teachers' rationale for their curricular use.

Conception of lesson. First, preservice teachers' beliefs and values, meaning conception of the lesson as related to their teaching preference or personal experience was a common theme. For example, one preservice teacher commented, "I used *enVision* the most. Mainly because this lesson was closest to what I was wanting to teach for this lesson." In this case, as in many others, once the preservice teacher knew the standard he was working with (i.e. dividing fractions by fractions) the preservice teacher entered the planning process already knowing the contents he wanted in his lesson—these preconceived ideas were most commonly based on the preservice teachers' own experiences, meaning that the preservice teachers had learned the content or had witnessed an experienced teacher delivering a similar lesson (Sherin & Drake, 2009).

Clearly presented/readable/time saving. As the preservice teachers read through the lessons, the presentation of the content with the curricular resources was also a deciding factor. Many preservice teachers preferred lessons they considered to be clearly presented, readable, and would help them save time planning because of organisational structures. For example, one commented, "I used *Saxon* the most because it was clear." Another noted, "*enVision* was rather clear cut and dry. It gave good questions to ask the students and the information was presented clearly. It even had the lesson stages planned out." These comments, as with many others, corroborated the idea that the preservice teachers noticed readability of lessons and were inclined to use resources that were visually clear and readable to them.

Conceptual approach/Supports students' understanding. Additionally, as preservice teachers read the lessons, they were cognizant of supporting students' understanding and often focused on curricular elements that would support a conceptual approach to understanding the division of fractions. As an example, one preservice teacher commented, "How they explained the

concept and what made sense to me and that I thought more students could be able to understand it." As with this example, many preservice teachers focused on the conceptual meaning of dividing fractions by fractions (as opposed to procedural competence) and emphasised wanting students to understand the meaning behind the tasks or problems.

Visuals/manipulatives. Finally, many preservice teachers cited the role of visuals or manipulatives as a reason for selecting and using specific lesson elements. One noted:

> I used the *enVision* math the most because it was a very visual model that could be used as a starting point in dealing with fractions. The way that *enVision* modeled how to make fraction strips was very transparent. This made the concept of fractions divided by fractions more accessible. I think that students need to have a very visual model to start with because of the complexity of the concept.

As in this example, many preservice teachers were specific about the models being used and the role of the models in supporting understanding.

> The thing I liked about the resources I used was the ability to model them in a very concrete way. I liked that I could spend time going through the fraction strips with the class. I also liked the pouring lemonade to demonstrate. Then the students would just have to count the jars filled. This helped to develop knowledge before introducing the standard algorithm. This is what I have read many times from my math book to delay introducing the standard algorithm until students develop a conceptual understanding.

In this example, the preservice teacher combined the visual support of fraction strips from the *enVision* lesson and the lemonade example in *CPM* as she provided rationale for her use of specific resources. As in this example, the preservice teachers noticed different elements in different resources and actually used those resources for those reasons. Consequently, the following section focuses on the rationale for use of specific resources.

Discussion and Implications

Knowing the resources preservice teachers use to plan lessons and understanding their reasons for selecting particular curricular elements provides teacher educators with information about how preservice teachers conceptualise curriculum use and then actually plan to include components of curriculum (offload), adapt materials (adapt), or create their own lessons without the use of materials (improvise) (Brown, 2009). At the preservice level, these findings provide data for the beginning point of the referenced trajectory of effective curriculum use (Taylor, 2016). More specifically, the findings illuminate the preservice teachers' process and outcome of interacting with materials, which is important for more fully understanding their resource interactions and to know how teacher educators can better support their development (Gueudet & Trouche, 2012). The act of reading resources, selecting curricular elements, and then writing (on the lesson plan and in the reflection) about selected elements draws heightened attention to those elements that were recorded. The following explores the specific decisions the preservice teachers made as they considered the resources and planned their lesson and considers these decisions from the teacher education context.

Multiple Resources

One unique aspect of this study is the incorporation of four different curricular resources, meaning textbooks lessons in this case, and the close study of how preservice teachers interacted with these resources when the opportunity to use elements from any of the lessons was seemingly equal. The lessons provided were not created similarly and they spanned a spectrum, with standards-based resources such as *CPM*, *Everyday* and publisher created resources, namely *enVision* and *Saxon*. Likewise, the resources varied with respect to the educative components included (Drake et al., 2014). Of the two non-reform based resources (*Saxon* and *enVision*), there were striking differences in the extent to which *enVision* was used as compared to *Saxon*, with 30 of the preservice teachers using *enVision* as a primary resource compared to 8 using *Saxon*. The structure of the two lessons in the larger unit context is different: *enVision* is focused around specific units whereas *Saxon* incorporates variations on topic in a revolving pattern. One may consider this to be a reason for the difference in use; however, recall that the preservice teachers were only given one lesson from the resources. Thus, they were likely not influenced by the overall structure of the resources. Those who used *Saxon* cited *closest to personal experience* and *lesson structure* as key reasons for the use, suggesting that the preservice teachers may have learned mathematics using similar lesson structure or approach. This confirms the findings of Sherin and Drake (2009) that teachers often adapt resources based on their early memories of learning mathematics, meaning those who preferred *Saxon* may have learned mathematics through a similar process. This raises further questions about elements of the lesson structure that led to these decisions and how preservice teachers considered *Saxon* to align with their former experiences.

In addition to focusing on the resources most commonly used, the finding that 12% of preservice teachers in this study decided to plan a lesson without incorporating any of the provided curricular resources speaks to preservice teachers' perceptions about lesson design, and comport with extant research that some preservice teachers equate effective teaching with limited curricular use (Feiman-Nemser, 1988; Nicol & Crespo, 2006). In the present study, despite being provided with a selection of resources and asked to plan a lesson, six preservice teachers opted for their own design, improvising, according to the definition of Brown (2009). These preservice teachers wrote that they did not use the resources—meaning this was a conscious explicit decision. These preservice teachers may or may not have read the resources provided; these decisions seemed to reflect improvising (Brown, 2009) because they were designing based on their prior knowledge. This is not to imply that their ideas did not come from resources they had read or used previously, but the ideas in the plan they wrote were not directly from the four resources to which they had access while they were planning this specific lesson. Therefore, in other definitions (Brown, 2009) this may not seem like an improvisation; however, according to Brown's definition this would be an example of improvising. These findings, along with prior research, further imply that some preservice teachers consider themselves better equipped to plan lessons without any resources than rely on curricular resources; this provides mathematics teacher educators with some data on curriculum use, which may be used to describe a component of an effective trajectory of use (Taylor, 2016). Of further interest, the preservice teachers in the present study were not able to access any other resources during the lesson design process, so they intentionally selected to not use any resource and considered that preferable over resource use.

Curricular Decisions

The findings of this study comport with those of Behm and Lloyd (2009) noting that variations exist in how preservice teachers use curriculum resources. This was true for the extent to which resources were used, as well as the prevalence of the use of some resources as compared with others. However, it should be noted that these participants had varying preparation activities, such as differences in their practicum experiences, that likely influenced their knowledge, understanding, and interactions with the materials. As evidenced in the data, the preservice teachers collectively used *enVision* much more commonly than the other resources. When providing rationale for their use of *enVision* they were significantly more likely to provide numerous reasons for their use as compared with the rationale for other resources. Even more interesting is the reasons cited for the heavy reliance on *enVision* were rarely mentioned as rationale for use of the other resources (i.e. useful problems, appropriate questions, engaging features, and real-world connections). This could be the result of a number of reasons. First, the elements referenced in the rationale for using *enVision* could not have been as prevalent in the other resources. For example, real-world connections may not have been as explicitly clear or relevant in *CPM*, *Everyday*, or *Saxon*, as it was in the *enVision* lesson and during the instrumentation process; these connections could have better resonated with the preservice teachers (Pepin, Gueudet, & Trouche, 2013). Second, the preference for *enVision* could be based on the preservice teachers' preconceived ideas that effective resources include certain elements. For example, prior to completing the lesson plan, the preservice teachers could have encountered experiences—including those from the methods course—in which they believed effective lessons included appropriate questions, engaging features, and real-world connections. Then, when reading the four lessons presented, they could have attended more closely to resources that included those types of elements. In other words, it is possible that the tenets preservice teachers hold about effective lessons influenced their use of the resources, rather than the resources having such striking content that those elements stood out. This again calls to question the contents of the methods course and the influence of what was taught in the course on the preservice teachers.

Further, of high interest is the low percentage (10%) of preservice teachers who mentioned philosophical beliefs as a reason for using *enVision*. Compared to the other resources, this was particularly low for *enVision*, yet many participants used *enVision* as a primary resource (see Table 7). This finding provokes further questions about the rationale provided for resource use. The following considers the rationale provided to further expose the nuances of resource interaction.

Rationale

As the preservice teachers wrote their justifications for their inclusion of certain curricular elements, or their offloading, the reasons stated (see Table 7) were specific to the curricular elements and their interaction, but did not fully unveil the broader reason they thought certain elements should be included or excluded. Consider *appropriate questions* as an example; some preservice teachers read the lessons, recognised questions, and then stated in their rationale that the questions were appropriate. The data rarely revealed why preservice teachers placed importance on appropriate questions. In other words, the rationale preservice teachers provided

in the lesson plans and reflections are closely tied to the elements within the curricular lesson—meaning they indicated they included an element because the questions were appropriate—but they did not commonly speak to the larger reasons for said decisions, meaning providing rationale for why they considered it important to have appropriate questions in a lesson. There were a select few preservice teachers who were more specific about their rationale and commented about their experiences and how that shaped their rationale. Land, et al. (2015) claim preservice teachers' curricular decisions are commonly based on their prior experiences coupled with current knowledge, which may be the case in the present study. For example, one preservice teacher noted that she had read about effective questioning in the text for the mathematics methods course; another noted that she had learned about the role of appropriate questions in the mathematics methods course. The notion that the preservice teachers were familiar with the lesson plan template could have influenced the results because this was not their first encounter with the specific template. That being said, preservice teachers typically did not provide information in their rationales that were indicative of why they thought what they thought. They provided reasons for their selection (i.e. "I want to include appropriate questions."), but did not delve deeply into describing their rationale for those decisions. Still, many of these decisions could be based on what they had learned in the course.

Teacher Education Implications

Ultimately, the findings of this study raise questions about preservice teachers' curriculum use and provide pragmatically useful information to the field of mathematics education. First, the process in which preservice teachers engaged could be replicated in other contexts, or with a variety of resources to provide teacher educators with data on how preservice teachers within their courses are thinking about curriculum use. Just as this study centred on the four most commonly used resources in the region, researchers within or outside the United States could uptake a similar process using resources most commonly used in their context. Understanding and building on this information is useful to know how to support preservice teachers as they design lessons. Second, the findings highlight the key reasons preservice teachers cited as rationale—appropriate rigor/useful problems and lesson structure—although these preservice teachers are not representative of all preservice teachers, the coding framework may be a starting point for teacher educators seeking to know more about how preservice teachers use mathematics curricular resources. Likewise, mathematics teacher educators should be cognizant of preservice teachers' desires to consider appropriate rigor, useful problems, and the structure of lessons and the links to the actual mathematics content, such as fractions. In methods courses, mathematics teacher educators may wish to pursue conversations around the decision-making process with respect to lesson planning, with a focus on rigor, problem complexity, and lesson structure in specific content domains because these were commonly referenced in the data. Additionally, studying the prior experiences of preservice teachers with curriculum before a methods course in comparison to their use of materials, may prove beneficial for further understanding their thinking around curricular resources.

Finally, the findings speak to the pedagogical design capacity of the preservice teachers, as they describe the extent to which resources were used or not used (Brown, 2009). As evidenced in the data, some preservice teachers offloaded their lessons, meaning they closely followed the materials provided. Many preservice teachers used parts of some resources and

parts from others, indicating they adapted resources. Others, as mentioned, did not use any of the resources and completely improvised to design their lesson. Their use of materials, being print textbooks in this case, provide teacher educators with insight about how preservice teachers may face actual lesson planning when they encounter multiple resources.

Conclusion

Although questions are raised about the broader reasons for preservice teachers' curricular decisions, the findings provide data on the reasons preservice teachers attend to certain lesson elements over others and provide increased understanding about their decisions to plan lessons. The intent of the study was to purposefully focus on one distinct component of preservice teachers' curricular interactions and gain a thorough understanding of the components from the textbooks they used and why they selected certain lessons or elements over others. For the field of mathematics education to have a full understanding of preservice teachers' interactions with resources, and for other fields to be informed, studies such as this must be conducted and considered in conjunction with existing studies on preservice teachers' curriculum use (e.g. Choppin, 2011; Drake et al., 2014; Nicol & Crespo, 2006). This work contributes to greater understanding of a "trajectory of effective use" (Taylor, 2013, p. 314) by providing insight about the curricular use capabilities and decision making of preservice teachers. If the intent is to support preservice teachers along a trajectory of curriculum use, then understanding and recognising the curricular resources and components that preservice teachers incorporate is important for knowing how to support their decision making. The findings of this study provide data and greater understanding on one component of the larger research base on curriculum use.

Acknowledgements

I would like to acknowledge Darrell Earnest, Lorraine Males, and Leslie Dietiker for their support of the concepts, ideas, and writing of this manuscript. This manuscript was a result of work initiated with the Service, Teaching, and Research (STaR) program.

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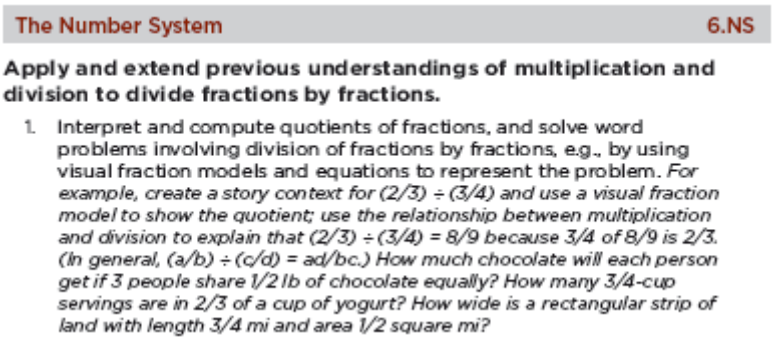
Appendix A

On the following template, all boxes and areas where preservice teachers write were expanded, so they had ample space to record their plan; the template is significantly condensed.

Lesson Planning

Throughout the semester we have spent time each week discussing effective mathematics teaching. The purpose of these discussions is to help you gain the ability to take what you have learned and apply your knowledge to your teaching practice. For this portion of the assessment, please consider everything you have learned in this course, including the readings and in class discussions, and apply your knowledge to design a sixth-grade lesson that incorporates the following standard. The lesson should also focus on at least one Standard for Mathematical Practice and may include other standards as well.



The Number System **6.NS**

Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

1. Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?*

You have access to the following resources:

-*Standards for Mathematical Practice* (p. 6-8)

-All Grade 6 Standards in the *Common Core State Standards for Mathematics* (p. 39-45)

-*College Preparatory Math*, Grade 6, Lesson 6.1.4, *How does it make sense?* (p. 548-557)

-*enVisionMath*, Grade 6, Lesson 9-3, *Dividing Fractions* (p. 206A-207B)

-*Everyday Mathematics*, Grade 6, Lesson 6-2, *Division of Fractions and Mixed Numbers* (p. 537-541)

-*Saxon Mathematics*, Grade 6, Lesson 68, *Dividing Mixed Numbers* (p. 349A-352)

As you design your lesson, be deliberate with your decisions and make this decision-making process as transparent as possible. Specifically, as you look through the resources and write out your plan, be sure to clarify **EXACTLY** why you included what you included in your plan. The important part of this project is clarifying your rationale for your planning decisions. I want to read what you plan and I want to know why you selected to include that component. Your rationale should be clear and should be based on what you know and have learned about effective mathematics teaching. The more specific you can be with why you made your

selection, the better. The **BOLD** questions throughout the template are included to make your thinking visible. Please answer all of these questions and include any additional details that would make your thinking clear.

Mathematics Lesson Plan

Subject	Topic
The big idea(s) or essential question(s) This is the big overall idea for the unit and may cross over subjects.	
Standards (You can list numbers) **Why THESE standards?**	
Objectives (what the students will be able to do as a result of the lesson)	
Materials	

LAUNCH (include anticipated time for each)

Launch:
Connect to previous learning, activate background knowledge, "hook" the learner and engage them in the content. **Activate and engage** the learner in the material, prior knowledge, a case study….etc.

Write your plan here (Include where you got the idea)	**What is your rationale for EACH part of this launch? (Why did you include the components you included? Be SPECIFIC.)**

INVESTIGATE (include anticipated time)
Explore and Discover actively engage in the construction process, problem solving and finding and processing information. Write a one sentence overview here.

Class activities and what will *you* do? This section includes the	**What will the students do?**	**What is your rationale for EACH part of this investigation? (Why did you include the components you**

mini-lesson, guided instruction and modeling where appropriate. You will scaffold the learner just enough for the learner to go out and struggle with the problem. Focus on what the teacher does AND what the learner does. It will also include independent, partner or group work, mid-point checks, and re-teaching whole group, small group. Assessment activities (formative) should be included.		**included? Be SPECIFIC.)**
(Include information about where you got your ideas)	**(Include information about where you got your ideas)**	
SUMMARISE (include anticipated time) Organize and Integrate: Organise and summarise information, new learnings, etc. and then integrated into existing structures (what we know and how we know it), thus restructuring. Write a one sentence overview here.		
What will you do? How do you come back together, or in small groups, to process what they did, link new learning to previous learning, clarify misconceptions etc., so that new learning structures can be created by the learner? It may also include checking for understanding through journaling, exit slips, etc.	***What will the students do?*** **(Include information about where you got your ideas)**	**What is your rationale for EACH part of this summarise? (Why did you include the components you included? Be SPECIFIC.)**
(Include information about where you got your ideas)		

Assessment:
(How you will know students met the objectives - include rubrics) Include in this section how you will check for understanding before, during and after. Will it be formal summative (after the learning) or formative (assessing learning along the way?) How will you include the learners in the assessment process? How will you allow the learner to be consumers of assessment data?

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_____

Why is this your assessment?

_____

_____

Accommodations/Differentiation:
This includes and goes beyond your special education students. How do you differentiate for the range of learners in your classroom? What information did you use to determine the need for differentiation? What data will you use to differentiate along the way? For future lessons?

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Why are you planning this for accommodations/differentiation?

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Curricular Resources

You were provided with the following resources:

-Standards for Mathematical Practice (p. 6-8)
-All Grade 6 Standards in the Common Core State Standards for Mathematics (p. 39-45)
-*Connected Mathematics Project*, Grade 6, Lesson 6.1.4, How does it make sense? (p. 548-557)
-*enVisionMath*, Grade 6, Lesson 9-3, Dividing Fractions (p. 206A-207B)
-*Everyday Mathematics*, Grade 6, Lesson 6-2, Division of Fractions and Mixed Numbers (p. 537-541)
-*Saxon Mathematics*, Grade 6, Lesson 68, Dividing Mixed Numbers (p. 349A-352)

Answer the following questions in as much detail as possible to make your thinking regarding these resources explicit:

1. What resource(s) did you use the most? Why?

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2. What about these resources led to your decision to use them?

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_____

3. What resource(s) did you use the least? Why?

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4. What about these resources led to your decision not to use them, or to use them less?

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Appendix B

Overview of Curricular Resources Provided

College Preparatory Math, Grade 6, Lesson 6.1.4, How does it make sense? (p. 548-557)

- Lesson 6.1.4 includes a lesson objective, "Students will extend their understanding of division to include division of fractions by fractions and represent division problems in multiple ways" (p. 548).
- The lesson overview, as stated in the materials, reads:
  In this lesson students will encounter fractions divided by fractions and interpret fractional answers. They will also address the fact that division by a unit fraction is the same as multiplying by the denominator of that unit fraction and be asked to come up with contexts for fraction divided by fraction problems. Finally, students consider the effects of division, which may tap into the common misconception that division makes things smaller. Since there are several concepts being developed, it is recommended that you proceed slowly enough to allow students sufficient time to clarify any questions and misunderstandings. (p. 548)

- The concept of dividing fractions by fractions is used within the context of reading music and the creation of a doll house using wooden boards. Several problems are presented for students.

Everyday Mathematics, Grade 6, Lesson 6-2, Division of Fractions and Mixed Numbers (p. 537-541)

- Lesson 6-2 includes a lesson objective, "To introduce an algorithm for division of fractions" (p. 537).
- The key activities are described, "Students learn a division algorithm for fractions and use it to divide fractions and mixed numbers." (p. 537)
- The lesson includes the first section, "Teaching the Lesson", in which students divide a whole number by a fraction, as related to measurement. This is followed by a section on introducing the division of fractions, in which the procedure of "invert and multiply" is specifically taught and students have a worksheet page in which they practice the procedure. The end of the lesson includes a section on "Dividing Fractions and Mixed Numbers" in which the materials direct teachers to focus on the "invert and multiply" procedure. Students then take part in "Ongoing Learning" and practice with review problems. Differentiation options are included for "enrichment" and "extra practice".

enVisionMath, Grade 6, Lesson 9-3, Dividing Fractions (p. 206A-207B)

- Lesson 9-3 includes a lesson objective, "Students can use multiplication to divide fractions." (p. 206A)
- An Essential Understanding statement is included, "A division expression with a fraction divisor can be changed to an equivalent multiplication expression."

- The lesson begins with a "Daily Spiral Review" and moves to an "Interactive Learning" section in which students are to use paper strips as a model to divide a fraction by a fraction. Students are then presented with the volume problem in which a fractionally-full container of lemonade is partitioned into fractional amounts. The materials included a "Guided Practice" section, followed by an "Independent Practice" section. A "Problem Solving" section then follows in which students solve several problems. The lesson concludes with a "Closure Section" that includes content for assessment and differentiation.

Saxon Mathematics, Grade 6, Lesson 68, Dividing Mixed Numbers (p. 349A-352)

- Lesson 68 includes two objectives, "Divide a mixed number by a whole number" and "Divide a mixed number by a mixed number" (p. 349A) Note: As confirmed by two researchers, this lesson was the closest lesson included in the Saxon materials for grade 6 that had content related to the division of fractions by a fraction.
- The lesson begins with a "Power-Up Discussion" that focuses on "Problem-Solving Strategies" and encourages students to "Use Logical Reasoning." The lesson then moves to include a "New Concept" in which fractional amounts of liquid are used an example, with a focus on using reciprocals. There is a section for fact practice in which students "write each improper fraction as a mixed number. Reduce fractions." Examples of fractional division are included and students are to engage in "Written Practice" that includes a mix of new learning and prior learnings. The "Written Practice" includes a "Math Conversation" section that includes questions the teacher can ask for certain problems. The lesson concludes with a section on "Looking Forward" to other related lessons.

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