



Research to Practice Article**Teachers' Lesson Design: Connecting Instructional Approaches to Noticing and Curriculum Use**

Based on the published SSM Journal Research Manuscript:
Teachers' Considerations of Students' Thinking During Mathematics Lesson Design

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Reforms in school mathematics have meant shifting demands on the role of educators within the classroom and further clarification of what it means to be an effective teacher (MET II, 2012). Teachers of mathematics should strive to utilize student thinking in all aspects of their practice from planning, enactment, and within post-lesson reflection which ultimately influences future planning (Morris, Hiebert, & Spitzer, 2009; NCTM, 2014; Simon, 1995). Unfortunately centering decisions around students' mathematical thinking within a cyclical process of teaching and reflecting is not a simple endeavor and likely results in a degree of risk-taking on the part of teachers as they develop proficiency in this process (Leinwand, 2012; NCSM, 2014).

The following describes a case study which examined how four, fourth-grade teachers utilized student thinking during planning and enacting mathematics lessons. The teachers were all located in one large suburban school representing one of sixty-eight elementary schools in the district. Teaching experience varied among the teachers, as did experience with the district-adopted curriculum. Ms. Anderson had recently graduated from a teacher education program and was in her first year of teaching. Ms. Brown had twelve years of experience, Ms. Creeggan had fifteen years, and Ms. Dale had taught for seventeen years (pseudonyms have been

used for all teachers in this study). The four teachers were responsible for teaching all subject areas on a daily basis.

The teachers in this study had the curriculum *Everyday Mathematics* as their primary, district-adopted resource and *Math 4 Today* as a warm-up activity, which could be used daily. Being that Ms. Anderson was a first-year teacher, she had not received any training in using either of these materials. The other three teachers had received professional development for *Everyday Mathematics* when the program was first adopted, but had received no subsequent training in the seven years prior to the study. Furthermore, the teachers indicated they had not attended professional development workshops or seminars in mathematics since the district-curriculum materials were adopted.

In addition to the curriculum resources, the teachers were responsible for delivering district-based "Benchmark Assessments" each trimester to all students. The assessments were deemed semi-secure, which meant teachers had access to the assessments prior to giving the test, but students were not allowed to see the materials. The structure of the assessments were primarily multiple-choice with the addition of one open-response question on each test. A highly-secure, state-mandated criterion referenced assessment was also presented to students once a year in the spring and items were multiple-choice and

constructed response. This assessment was not accessible to the teachers prior to its delivery.

Research Topic

The connection of how teachers plan for a given lesson and then deliver that same lesson based on what they notice during instruction offers an area not fully addressed by previous literature. For this reason, the current study addressed the following research question: How do teachers consider students' mathematical understanding when planning lessons? The study is theoretically framed with literature surrounding professional noticing (Jacobs, Lamb, & Philipp, 2010; van Es, 2011; van Es & Sherin, 2008) and specifically addresses how teachers recognize student thinking and then mobilize their interpretation of this thinking to form a response to what has occurred (Jacobs et al., 2010). Analysis followed processes relating to a *grounded theory* approach; this methodology requires multiple iterations of data review and has the "purpose of building theory from data" (Corbin & Strauss, 2008, p. 1). Understanding research which builds theory assists teachers by offering an explanation of current practices and provides the opportunity for reflection which may lead to systemic dialogue or change.

Multiple data sources were used as is customary with case-study research in order to produce a trustworthy understanding of the data (Creswell, 2013; Yin, 2009). Each teacher participated in five teaching sets consisting of a pre-interview, teaching observation, and then a post-teaching interview. All of these interactions were recorded and later transcribed for analysis. Lesson plans and relevant teaching reflections associated with the given lessons were also collected as well as any charts, graphs, or screenshots from electronic devices used during the observed lesson. Finally, one in-depth interview was conducted with each teacher at the conclusion of the study.

Discussion of Findings

Three distinct approaches to planning and enactment emerged during the analysis of the data: (a) adapting, (b) producing, and (c) regulating. The following sections describe each of these in more

detail and provide further connections to classroom practice.

Planning Themes

In this study, Ms. Anderson took an *adapting* approach and made decisions for subsequent instruction based on students' conceptual understanding in mathematics. When confronted with unanticipated student thinking during instruction, she used student misconceptions to modify the current lesson and plan subsequent lessons that addressed the confusions. Ms. Anderson continued to focus on missing concepts until students were able to demonstrate an understanding of the content. During her reflection she discussed this further:

Basically my planning is based on their ability. Like if we do something and I see that they are having a really hard time with it, then we won't move on until I feel like they have a firm grip or grasp on whatever I am trying to teach them. (Ms. Anderson, March 11, 2010).

Even though Ms. Anderson was a first year teacher and lacked experiences to anticipate all student thinking that arose during a lesson, she utilized the student thinking that surfaced during the lesson for future planning.

Ms. Creeggan and Ms. Dale could be described as taking a *producing* approach as they were most concerned with student skills and procedural fluency in using algorithms. Both teachers viewed their role as preparing students for district and state summative assessments and therefore selected materials that reflected topics they knew would be later assessed and excluded those that would not be evaluated through these measures. Ms. Creeggan commented, "We don't have the time to be wasting on an activity that is not relevant to what we are going to be looked upon" (Ms. Creeggan, Interview, March 23, 2010). Both teachers taught new content when most students demonstrated knowledge of a given topic.

Ms. Brown used her curriculum materials as a guide for the content which should be taught and followed the scope and sequence with fidelity, which would be an example of a *regulating* approach to

planning. Routines were an important part of her instructional style and this meant she addressed a new topic each day and did not reteach content—instead, she left that to others who worked with the students such as resource teachers or parents. She preferred the Houghton Mifflin curriculum to that of Everyday Mathematics; she believed it better addressed the procedures on which students would be later assessed.

Implications for Practice

Leahy et al. (2005) state “teachers using assessment for learning continually look for ways in which they can generate evidence of student learning, and they use this evidence to adapt their instruction to better meet their students’ learning needs” (p. 23). The findings of this research show that although some of the teachers in this study were focused on evaluating students, they were limited in the ways they approached this process. Ms. Creeggan, Ms. Dale, and Ms. Brown all focused on procedural skills which appeared on either assessments or within the textbook. Ms. Anderson was the only teacher in the study who used student thinking to determine her instructional planning. Current reforms necessitate a widened view of assessment and the consideration of student thinking in this process, which can mean teachers making changes to their practice (NCTM, 2014).

Mason (2011) discusses that the purpose of developing the ability to notice student thinking is being able to react to future classroom events. Teachers who use an adapting approach to planning integrate noticing into their process of making classrooms decisions, but those who use a producing or regulating approach may be missing opportunities simply because their focus is on specific skills needed for testing or skills which are prescribed by the curricular resources being used. Teaching is naturally a process of self-reflection and this study may provide a lens for analyzing classroom practices and improving on future instruction.

Additional Resources

Based on these findings, teachers may want to consider reading *A New Lens on Teaching: Learning*

to Notice (Sherin & van Es, 2003) which provides specific issues for teachers to contemplate when considering how they notice students’ thinking and then plan subsequent instruction. Examples are included for teachers to design their own approach to noticing. Further, *Three Strategies for Opening Curriculum Spaces* (Drake et al., 2015) describes how teachers can open spaces through the use of curriculum materials to connect to children’s multiple mathematical knowledge bases. Essentially the article describes how to use curriculum materials to support students’ mathematical understandings.

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