Chapter 10
Embedding Formative Assessment in the Mathematics Classroom Through Writing, Discourse, and the Use of Digital Tools:
Embedding Formative Assessment in the Mathematics Classroom

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ABSTRACT

Formative assessment in mathematics involves a multi-faceted process of determining what data to collect, collecting data, analyzing data, and interpreting data to make and implement future instructional decisions. In this chapter we describe two separate efforts; one where the first author served a classroom teacher and used various writing activities in the process of formative assessment, and one where hundreds of teachers in North Carolina completed a year-long professional development project focused on the use of the digital formative assessment tool, AMC Anywhere, and related instructional materials. Implications for these projects include a need to provide ongoing support in all aspects of the formative assessment process so that teachers see each aspect as part of a larger picture.

INTRODUCTION

Changes in mathematics education are reflected in the goals, standards, objectives, research, curriculum, and policy (National Council for Teachers of Mathematics, 2014; U.S. Department of Education, 2008). Schoenfeld (2015) describes the qualities of a proficient mathematics students and the central goals of the Common Core State Standards as having mathematical knowledge that is connected rather than siloed in isolation. Further, proficient students reflect on their own thinking, hold beliefs that are productive, and develops persistence for problem solving (Schoenfeld, 2015). In addition to considering what mathematically proficient students do, recommendations about effective teaching call for teachers to consistently check their students understanding and use data to plan subsequent instructional activities (Fuchs & Fuchs, 2016; NCTM, 2014).

Koellner, Colsman, & Risley (2009) discuss the purpose of formative assessment as data that is specific to an individual learner and provides the teacher with information that should directly affect instruction. Formative assessment is ongoing and creates a stream of data that continues, this allows for instructional plans to consistently reflect the needs of individual students (Joyner & Muri, 2011). This flow and cycle of information promotes an understanding of a students' path and is the foundation for instruction (Andrade & Cizek, 2010) and the feedback occurring between students and teachers expands students' learning (Baroudi, 2007; Huinker & Freckmann, 2009); however, formative assessment used as benchmarks to project future performance limits the possibility for targeted and effective instruction (William and Leahy, 2007).

Formative assessment has also been written about as assessment for learning (Heritage, 2010; NCTM, 2014). Leahy, Lyon, Thompson, & Wiliam (2005) noted that "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). Formative assessment provides insight into student learning and guides teachers in providing the instructional support that is needed on an individual basis.

Duckor, Holmber, and Becker (2017) suggest that formative assessment goes beyond checking for misconceptions and should focus on the relationship between the student's understandings and a productive response from educators. They describe a framework of formative assessment designed to assist teachers with the following aspects: Priming, posing, pausing, probing, bouncing, tagging, and, binning, (Duckor, Holmber, and Becker, 2017). Priming is defined as a set of norms and groundwork, posing means to ask questions that are aligned with the learner, pausing is to give proper time, probing is to follow up, bouncing is the intentional soliciting of responses, tagging means to create a record of responding, and binning is to categorize. These moves provide opportunity for one-on-one discourse that may be expanded to include the whole class. There are many ways for teachers to engage students in formative assessment.

Torrance and Pryor (1998) found that despite the fact that teachers reported that formative assessment had become a focus in their classroom students were not actively engaged in their own assessments and reflection. Andrade and Valtcheva (2009) suggest self-assessment is a part of formative assessment and promotes student's ability to reflect on their work. It is important to create opportunities for students to develop self-regulation strategies so they can participate thoughtfully in self-assessment.

This chapter intends to illustrate practices that embed formative assessment for early childhood into elementary mathematics classroom. It is important to provide examples and reveal how different activities may be infused into the mathematics classroom to serve as formative assessment. Many educators note

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