Literature Review

Assessment for Learning/ Formative Assessment

Assessment for learning was originally conceived of as formative assessment and placed in contrast to summative assessment. Michael Scriven proposed the terms formative and summative in 1967 to explain two distinct roles that evaluation could play in evaluating curriculum. In the years to follow, Benjamin Bloom and colleagues (1969; 1971) suggested applying the same distinction to the evaluation of student learning— "what we tend today to call assessment" (Wiliam, 2006, p. 283). Subsequently, the terms formative and summative have become fundamental to understanding assessment in education. Summative assessment focuses on summing up or summarizing achievement of students, classes, schools, etc. (Bloom, Hastings, & Madus, 1971; National Research Council [NRC], 2001; Sadler, 1989; Shavelson, 2006). Formative assessment centers on active feedback loops that assist learning (Black & Wiliam, 2004; Sadler, 1989; Shavelson, 2006). Recently, some scholars have begun to refer to summative assessment as assessment of learning and formative assessment as assessment for learning (Black & Wiliam, 2003; Broadfoot, 2008; Gipps & Stobart, 1997; Stiggins, 2002).

In the years since Scriven's identification and Bloom's extension of summative and formative assessment types, "the interest (and investment) in summative assessment has far outstripped that accorded to formative assessment" (Stiggins, 2005, p. 326). Black and Wiliam (2003) discuss in some detail the ups and downs of formative assessment during the 1970s through the late 1980s. In the late 1980s, two substantial review articles (Crooks, 1988; Natriello, 1987) and a seminal piece on the function of formative assessment in the development of expertise (Sadler, 1989) boosted interest in assessment for learning. This growing interest appeared to be substantiated with Fuchs and Fuchs' (1986) meta-analysis and Black and Wiliam's (1998) comprehensive review of about 250 articles. Both studies reported significantly positive student learning gains. The Black and Wiliam (1998) work demonstrated gains of a half to a full standard deviation, with low-achieving students making the largest increase. Although Dunn and Mulvenon (2009) have recently contested the conclusiveness of these two studies,[1] other recent research has also shown positive

[1] It is worth noting here that Black and Wiliam only claimed the effect sizes that since have been challenged in their *Phi Delta Kappan* summary of their research paper. Bennett (2009) also raises issues about the effect size claims. However, perhaps Lorrie Shepard (2009) most aptly addresses the issue at hand, stating the following about the Black and Wiliam research: "Attention has been focused on the positive effect sizes they reported, rather than the underlying theories that explain how formative assessment works. Black and Wiliam drew together diverse bodies of research including studies addressing: teachers' assessment practices, students' self-perception and achievement motivation, classroom discourse practices, quality of assessment tasks and teacher questioning, and the quality of feedback. Because of the close overlap between formative assessment and feedback, they provided considerable detail regarding the features of effective feedback, drawing from both the cognitive and motivational literatures" (p. 32). It is this body of research that provides evidence for the process of formative assessment as conceived by Black and Wiliam.

impact on student learning (e.g., Black, Harrison, Lee, Marshall, & Wiliam, 2004; Ruiz-Primo & Furtak, 2006). Moreover, Dunn and Mulvenon (2009) were unable to present any examples of formative assessment producing negative achievement results.

In addition to the consensus emerging around the potential benefits of formative assessment practice, scholars generally agree that formative assessment is the process of using information about students' learning on the course of instruction to make decisions to improve learning (Atkin, Black, & Coffey, 2001; Bell & Cowie, 2001; Black, 1993; Black, Harrison, Lee, Marshall, & Wiliam, 2003; Black & Wiliam, 1998, 2004; Harlen, Gipps, Broadfoot, & Nuttall, 1992; Harlen & James, 1996; Tunstall & Gipps, 1996; Shepard, 2000). How the process of formative assessment is conceptualized and implemented still varies somewhat, but all of the researchers listed above agree that regular testing and simply informing students of their scores does not constitute formative assessment. Instead, according to Black and associates (2004), the evidence of student understanding (and learning) evoked from one round of the formative assessment process should be "used to adapt the teaching work to meet learning needs" (p. 2).

In 2007, Formative Assessment for Students and Teachers State Collaborative (FAST SCASS) of the Council of Chief State Officers with national and international researchers in formative assessment identified five attributes of the formative assessment process from the literature. They are as follows:

- Learning progressions should clearly articulate the sub-goals of the ultimate learning goal.
- Learning goals and criteria for success should be clearly identified and communicated to students.
- Students should be provided with evidence-based feedback that is linked to the intended instructional outcomes and criteria for success.
- Both self- and peer-assessment are important for providing students an opportunity to think metacognitively about their learning.
- A classroom culture in which teachers and students are partners in learning should be established.

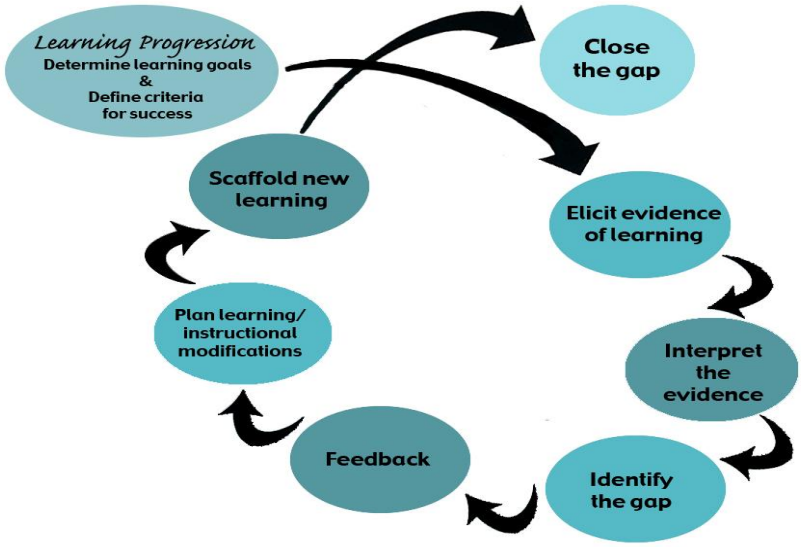
Margaret Heritage (2007) of the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) folded the attributes into a model of the formative assessment process that is applicable to the discussion to follow (see Figure 1 for one recently presented version). The process focuses the work on the following four elements of formative assessment: learning progressions, including learning goals and success criteria, identifying the gap, eliciting evidence of learning, teacher assessment, teacher feedback, and student involvement.[2] We provide a brief review of each as follows.

[2] One can also track the iterations of Heritage's more detailed formative assessment model (2009a, 2009b) over time. The model is quite logical, but due to considerable amounts of overlap within it, we found it difficult to confine our review to its framework.

Learning Progressions

Learning progressions define the pathway along which students are expected to progress in a domain. They identify the enabling knowledge and skills students' need to reach the learning goal as well as provide a map of future learning opportunities. Heritage, Kim, Vendlinski, and Herman (2009) explain that learning progressions are important to the development of progressive sophistication in skills within a domain. One view of learning progressions suggests that they are presented to students as a continuum of learning, accounting for different rates of learning (DeMeester & Jones, 2009). The rate of individual student's progress may vary along the learning progressions, but progressions should ultimately connect the knowledge, concepts, and skills students develop as they evolve from novice to more expert performances (Heritage, 2008). In this way, teachers and students should be able to "see and understand the scaffolding they will be climbing as they approach" (Stiggins, 2005, p. 327) learning goals. In addition, if learning is derailed at any point, a teacher can identify this and adjust accordingly.

Figure 1: Formative Assessment Model.



Margaret Heritage's "Formative Assessment Model" (2009a, 2009b, 2010).

Learning Goals

Perhaps the first step of the whole assessment for learning process is the establishment of student learning goals (Wiggins & McTighe, 2000)—"what is worthy and requiring understanding" (DeMeester & Jones, 2009, p. 5). Currently, these ultimate goals are probably most represented by state standards or in Iowa by the Core Curriculum. According to Heritage (2007), however, most state standards "do not provide a clear progression for understanding where students are relative to desired goals" (p. 142). Even without a predetermined clear progression, teachers should have a "big question" in mind (Black & Wiliam, 2009). Goal orientation research indicates that students are more likely to be

"challenge seekers" than "challenge avoiders" (Meyer, Turner, & Spencer, 1997) when motivated by process over performance. Student understanding of goals have critical motivational and cognitive impacts (Brookhart, Andolina, Zuza, & Furman, 2004), as students develop agency and self-worth (Covington, 1992) while accurately appraising their own work (Sadler, 1989).

Criteria for Success

Success criteria are the indications that teachers and students use as checks on learning. They should be communicated clearly to students to minimize potentially debilitating discrepancies among what students believe to be worth learning (Wiliam, 2007). Success criteria are the guide to student learning (Heritage, 2007), providing a framework within which assessment for learning exists and makes possible the interpretation of evidence (Clarke, 2005). The evidence of where students are related to the learning goal and success criteria—the gap— informs instructional decisions for teachers.

Identifying the Gap

Drawing from Sadler's (1989) work, Wiliam and Thompson (2007) noted three key processes in teaching and learning: establishing where the learners are in their learning, establishing where they are going and what needs to be done to get them there. The model set up by Sadler (1989) stresses the importance of identifying the "gap" between what a learner knows currently and the desired goal for him/her to reach. Establishing an appropriately challenging goal is crucial. If a student perceives the gap as too difficult, then it may become unattainable. On the other hand, if the gap is perceived as being too small, the student could perceive it to be not worth pursuing. As in the Goldilocks metaphor, the gap needs to be "just right."

In instructional terms, the "just right" (Heritage, 2007) gap has been conceived of by educational psychologists as the zone of proximal development (Vygotsky, 1978; 1986). The zone of proximal development is the area where Vygotsky hypothesizes learning and development take place. It is defined as the distance between what the child can accomplish during independent problem solving and the level of the problem solving that can be accomplished under the guidance of an adult or in collaboration with a more expert peer. Through these processes, cognitive growth occurs as the child internalizes problem solving processes.

Wood, Bruner, and Ross (1976) devised the term "scaffolding" to characterize the support that adults (teachers) give to learners in the zone of proximal development to move them from what they already know to what they can do next. Building on this, some scholars point out that formative assessment should identify what students might achieve in the zone of proximal development (Shavelson, 2006; Torrance & Pryor, 1998). In other words, "formative assessment gathers and uses information about students' knowledge and performance to close the gap between students' current learning state and the desired state by pedagogical actions" (Shavelson, 2006, p. 3). Thus, according to Shepard and team (2005), scaffolding and formative assessment are complementary concepts.

The impact on student learning from identifying the individual student's learning gap is illustrated in a study by Bergan, Sladeczek, Schwarz, and Smith in 1991. This study involved 838 five-year old students from disadvantaged home backgrounds in six different regions of the United States. The teachers in the experimental group were provided formative assessment training in developing pre-assessments, using observational strategies to assess ongoing progress, and using diagnostic assessments to locate each student within a learning progression. Progress in reading, mathematics, and science was monitored and found to show considerably greater cognitive gains for the experimental group than the control group. Additionally, only 1 in 17 students in the experimental group were referred for having particular learning needs and only 1 in 71 were placed in a special education program. The corresponding figures for the control group were 1 child in 3.7 and 1 in 5 placed in a special education program. The researchers concluded that the capacity of children is "underdeveloped in conventional teaching" so many students are referred for special services unnecessarily.

Eliciting Evidence of Learning

At its core, formative assessment must collect quality evidence of learning in order to be effective. According to Heritage (2009a, 2009b), no single way to collect evidence is necessarily better than others, but decisions should be made appropriate to the purpose, aligned with learning goals, embed the concepts and skills that are the focus of the lesson, and provide sufficiently detailed information for action. The various strategies for evidence gathering can be categorized into the following three broad types: curriculum-embedded (or systematic), planned, and on-the-fly (or spontaneous) (Heritage, 2007). Systematic strategies utilize on-going interactions, tasks, or curriculum-embedded assessments that teachers employ by design to elicit evidence at key points within lessons. An example might be the use of science journals, end-of-section questions, or mathematical representations developed during a lesson cycle. In planned-for interactions, teachers plan questions in advance of the lesson to elicit student thinking during the course of instruction, or they structure student discussions so that they will gain insights to student thinking through the course of the discussion. Spontaneous assessment may be anticipated by the instructor but is unplanned and arises during the course of the lesson to provide evidence of student learning. For example, during a discussion the students might say something that the teacher had not anticipated and which leads the teacher to ask further probing questions. These questions are not pre-planned but are prompted by student responses.

Teacher Assessment

If teachers are to build on students' knowledge and previous learning, they must be able to identify what that previous learning is. "Teachers' skills in drawing inferences from students' responses are crucial to the effectiveness of formative assessment" (Heritage, 2007, p. 144). In this vein, Heritage (2007) identifies the following five components of the students' previous learning (p. 143):

- [Students'] level of knowledge in a specific content area
- Their understanding of concepts in the content area
- The level of their skills specific to the content area
- The attitudes the students are developing
- [Students'] level of language proficiency

Although modifying planned learning and/or instruction allows room for error while maintaining advancement toward learning goals, to draw accurate inferences teachers must possess domain knowledge, pedagogical content knowledge, and a wide range of formative assessment strategies (Heritage, 2007). Many of the alterations necessary for improvement focus decisions on pedagogical action and strategies and on students' learning tactics (Heritage, 2009a). Assuredly, "a critical component of quality formative assessment is teachers' use of the evidence obtained from students' performance on assessment tasks to adjust instruction and to guide students in adjusting their learning strategies" (DeMeester & Jones, 2009, p. 7).

Teacher Feedback

Feedback has been widely cited as a key attribute of formative assessment, but quite a few studies have noted that the typical feedback provided by teachers in the form of grades, comparisons of students' score relative to peers, or low levels of specificity has either no effect on student learning or debilitating effects (Bangert-Drowns, Kulik, Kulik, & Morgan, 1991; Kluger & DeNisi, 1996; Mory, 2004). According to Shute (2008), formative, or descriptive, feedback is "information communicated to the learner that is intended to modify his or her thinking or behavior for the purpose of improving learning" (p. 154). More broadly, Black and Wiliam (1998) suggest that formative assessment includes the use of any feedback to adjust teaching and learning activities. A meta-analysis conducted by Hattie and Temperley (2007) reveals high effect sizes when students are informed about the task at hand and how to perform it more effectively, with lower effects for interventions focusing on target-setting and even lower effects where only praise, rewards, and punishment are given. Not surprisingly, feedback reduces the student's uncertainty about his or her performance and progress (Ashford, 1986; Ashford, Blatt, & VandeWalle, 2003).

Appropriate descriptive feedback should provide students with some combination of verification (linked to the learning goal and criteria for success) with elaboration (e.g., written communication) (Shute, 2008). The elaborate component of feedback should be detailed and specific to how the learner can improve or advance the learning but not too complex (Shute, 2008). In addition, feedback should be goal-directed, providing learners

with information about their advancement toward specific goals. This approach could have some of the following benefits: task focus and simplification, learner motivation, and identification of the "just right" gap (Bransford, Brown, & Cocking, 1999; Paas, Renkl & Sweller, 2003; Sweller, Van Merrienboer & Paas, 1998).

Student Involvement

Although teachers have traditionally been responsible for charting the waters on behalf of learners, Black and Wiliam (2009) contend that "since the responsibility for learning rests with both the teacher and the learner, it is incumbent on each to do all they can to mitigate the impact of any failures of the other" (p. 7). Furthermore, students should be activated as instructional resources for other students as well as the owners of their own learning.

Peer Assessment

Large learning gains can occur when students serve as learning resources for one another, as evidenced by Slavin, Hurley, and Chamberlain (2003). However, two elements are critical for peer assessment to be valuable. First, students must work as a group or team and not just in a group or team. Second, each student must be held accountable in some way. Sadler (1989) points out that students working with other students and their work could provide the following advantages: the work is of the same type, students interact with multiple designs and procedures to reach solutions, and students interact with a wide range of imperfections.

Self Assessment

Research shows that when students take an active role in "monitoring and regulating their learning, then the rate of their learning is dramatically increased" (Wiliam, 2007, p. 3) and perhaps doubled. Not surprisingly, cognitive theories note a central role for meta-cognition in students' learning (NRC, 2001). The term meta-cognition often refers to a process of self-monitoring and to general reflections on one's own thinking. Such self-consideration is a key component of formative assessment, as students collaborate with teachers in developing a shared understanding of their current learning status and identify how to move forward (Sadler, 1989).

In formative assessment, student self-regulation is highly related to meta-cognition. Self-regulated learners "adaptively regulate their use of cognitive tactics and strategies in tasks" (Winne, 1996, p. 327). The emphasis on student self-monitoring and learning adjustment enables them to develop a repertoire of cognitive strategies to improve their learning. As Dweck (2000) notes, even when students are not experiencing success they can learn to see ability as something that they can grow themselves as evidenced by their responses to challenges. However, teacher support is critical to embedding such a confident and persistent student approach. If teachers do lead students successfully, reliance on repeated self assessments could instruct the learner on how to improve his or her future performance (Stiggins, 2006).

Learning Culture

To use assessment in the process of learning, Lori Shepard (2000) asks educators to consider the changes necessary in classroom practices that would enable assessment to be used as part of the learning process. An assessment-for-learning school is a place where everyone is learning together, and where assessment is part of teaching and learning without dominating students or processes (Assessment Action Group/AiFL Programme Management Group [AAG/APMG], 2002–2008). Although some students are always willing to work harder and engage in formative assessment practices, other students are "imprisoned in the identity of a bad pupil and an opponent" (Perrenoud, 1991). A learning climate more reflective of a collaborative partnership among teachers, students, and parents opens the door for all to view assessment as a source of insight rather than a form or meting out rewards and punishments (Shepard, 2000).

Conclusion

A growing tide of enthusiasm for formative assessment is apparent in education research and practice. Even as researchers such as Paul Black, Dylan Wiliam and Margaret Heritage continue to develop the theoretical framework of formative assessment, studies since Black and Wiliam (1998) have continued to highlight positive impacts on student learning at various grade levels and in different content areas. For one recent example of the impact of formative assessment on science education, Applied Measurement in Education devoted a recent issue to formative assessment work conducted by researchers associated with Stanford University, the University of Hawaii, and The Curriculum Research and Development Group (Ayala et al., 2008; Brandon et al., 2008; Furtak et al., 2008; Shavelson et al., 2008; Yin et al., 2008). Topics included formative assessment's relation to or impact on curriculum, the student learner, and student motivation. As Dunn and Mulvenon (2009) illustrate in their critique of Black and Wiliam (1998), many of the studies conducted on formative assessment have flaws and more research is needed, but the fact gleaned from the research conducted to date is that nearly all of the studies link formative assessment to meaningful student learning gains.

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