The Role of Formalized Tools in Formative Assessment

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Abstract

In this paper we present a supporting argument in the debate "There is a role for formalized tools in formative assessment."[1]

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The notion that formative assessment can be accomplished simply through administration of out-of-the-box testing products runs counter to recent understanding of what formative assessment is and how it works. *Formative assessment* does not refer to a type of testing instrument, but rather is a process for improving instruction dynamically through use of student data (Black & Wiliam, 1998; Shepard et al, 2005). Specifically, the Formative Assessment for Students and Teachers (FAST) State Collaborative on Assessment and Student Standards (SCASS) developed a definition for formative assessment, based on a synthesis of the research literature:

> *"Formative assessment is a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes."* (CCSSO, 2008)

Given the emphasis on organic teacher-student instructional interactions, the question arises whether formalized tools—standalone testing instruments, item banks, instructional improvement systems, etc.—can meaningfully support the formative assessment process. At one end of the argument is the idea that at the heart of formative assessment lies a joint exercise conducted between student and teacher. For example, students must agree to set and maintain learning goals while teachers support students achieving these goals, and that teachers and students must in concert provide and respond to feedback. To carry out formative assessment, teachers must be proficient in developing their own evaluative tools as part of their instructional practice. Reliance on formalized, external tools risks distancing teachers and students from this process. To the extent that support can come from the outside, it should be limited to professional development, mentoring, and assisting the establishment of communities of practice.

On the other side of the argument is the notion that the quality of instructional decision-making is limited by the quality of the data it is based on. Missing from the above definition of formative assessment is an explication of what could be used in the process to generate data in the feedback process. The wealth of writing about formative assessment provides many ideas of how evidence of student learning can be generated: classroom discussions and questions, student work or products/performances, student self or peer evaluation, one-to-one student interviews. In this paper we argue in support of the debate topic, namely that formalized tools can improve formative assessment. The key point we present is that formalized tools can play a supportive and educative role for teachers by codifying content and representing ideas about student learning and cognition to improve the information teachers use to guide instruction. The premise for this position is not that formalized tools should serve as the *sole* resource for formative assessment, rather that there is *a* role for them.

Another perspective on this position comes from the meaning of the term *formalized*, namely, "to give a certain or definite form to**:** shape." as provided by the Merriam-Webster online dictionary. From the same source, a tool can be considered as "device that aids in accomplishing a task." In other words, a formalized tool in the context of this debate is one that has a particular structure or form to aid in the assessment task. We argue that one way in which formalized tools can serve a valuable role is to codify, or give form or shape to ideas that come from the learning sciences research. As such, these tools can embody knowledge from the cognitive learning sciences in a way that is accessible to and usable by teachers.

Examples of formalized instruments that can play a role in formative assessment range from individual questions developed based on an understanding of how students learn, to larger item banks from which teachers can select items to develop short classroom assessment and quizzes, to educational games with embedded or "stealth" (Shute, 2011) assessments. These assessment tools may be accompanied by various infrastructures that support their use in the classroom, such as clickers to support the collection of student responses or professional development to support teachers integrate the tools into their instruction. The primary purpose of these formalized tools is to provide evidence of student learning in a way that teachers can easily access, process and use to inform next instructional steps. Formalized instruments can provide high quality data by relying on research-based, field-tested evaluative instruments, including diagnostic assessments and assessments based on carefully developed learning progressions, to identify gaps in student knowledge and skills. Assessment development techniques such as evidence-centered design can be applied during the instrument development to improve the validity of interpretations based on student work.

As noted earlier, these formalized tools can also serve an educative role for teachers, by modeling what would be an appropriate assessment of a standard, a misconception, or an aspect of a learning progression. This educative role is of particular value for less experienced teachers who have not yet had sufficient time in the classroom to develop a sense of how student understanding around various concepts develops over time. In addition, formalized tools can be developed to provide accurate assessments for a more diverse set of students than teachers may have the opportunity to gain experience with, including students with disabilities and English language learners.

We provide two examples of formalized tools that were developed to support the formative assessment process. While the assessment role is more self-explanatory, the following two research projects serve as examples to illustrate both the assessment and educative roles for formalized tools.

The first project was an IES-funded project (IES reference R305K040051) to create a bank of items for mathematics and science teachers that drew on the misconception literature (Wylie & Ciofalo, 2008). Each multiple-choice item that was developed drew on at least one previously identified student misconception. The intent was that teachers could select, from the complete set of items, one or two that were directly relevant to the particular content they were teaching and use them as part of a classroom discussion. For many teachers who were involved in the review and piloting of these items, they found the student misconceptions to be recognizable based on their teaching experience although they had not previously thought about student ideas in that way. In other words, they had often seen similar patterns of misunderstanding or partial understanding with their own students, but had not considered those patterns more broadly, had not considered student misconceptions to be predictable, nor thought about addressing them directly during instruction.

A common misconception that students have about the median is that when finding the median of a set of even numbered data they sometimes struggle to see that the median may not be one of the numbers in the data set and that it could be the mean of the middle two numbers (when ordered). We wrote a simple question to address this misconception, as shown in Figure 1.

What is the median for the following data set?

38 74 22 44 96 22 19 53

A. 22
B. 38 and 44
C. 41
D. 46
E. 77
F. This data set has no median

Figure 1: A multiple-choice question targeting a common misconception about the median.

This item would likely not get through a review for a standardized assessment, having two distracters that look distinctly different from the others, but it was written to stimulate classroom discussion once the teacher would poll the class to see the range of responses from students. Her next steps would depend on the range of student selected responses, and the rationales that they would provide to support their answers. If all students selected option C and could explain it clearly there might be no need to pursue the matter further. Other patterns of responses might result in students forming small groups to talk about the options, small-group instruction by the teacher, whole class discussion, individualized conversations with students who still were having difficulties.

The tool only provides an evidence-collecting opportunity, but it is still up to the teacher to analyze the evidence and make instructional decisions based on her conclusions.

We consider these misconception questions to be an example of a "formalized tool." The item bank was generated from a thorough review of the misconception literature in mathematics and science, with teacher feedback and review, based on external funding and is a resource from which teachers can select. It is also a tool in the sense that teachers when to use this device to help them accomplish a particular task: that of identifying whether students have a common misconception that students predictably bring to a learning situation and which, if left unaddressed, could have a negative impact on future learning. We also saw that these misconception items were educative for teachers: they were not familiar with all this misconceptions or thought that their students would not have them. On many occasions, teachers returned to a professional development meeting to debrief on the questions and shared with their group their surprise to find that students selected an answer choice that represented a misconception and that on further probing held it quite firmly. The item bank and the examples of how to use the questions embedded in classroom discussion also provided a model for classroom discussions that the teachers could use in other contexts. Since classroom questioning and discussions are familiar practices to teachers, incorporating questions from this resource did not require significant adjustments to practice in some ways. However, the questions provided teachers, especially less experienced ones, with important insights into how students think and develop understanding. While teachers could develop questions like this on their own, it was perhaps more efficient to create a set for them, and then support them through professional development as they figured out how best to use them, and what to do with the information once particular student misconceptions were identified. However, the set of questions also served as a model for teachers and part of the professional development focused on how they could write, informally pilot, and revise their own misconception questions to address content that was not covered in the original set of questions.

The second project that serves as an example of how a formalized tool can support both assessment and teacher educative roles is coincidently also an IES-funded project (IES reference R305A100518). This project is focused on the use of student learning progressions in middle school mathematics. In this project we are developing two kinds of assessments that provide different types of formative information, but with a common purpose of providing teachers with instructionally useful information. We call the assessment types a *locator* assessment and *incremental* tasks (Arieli-Attali, Bauer & Wylie, 2012).

A locator assessment is one that would place student understanding with respect to levels of understanding within the three learning progressions. This assessment will be

computer delivered and administered in a single class period. Teachers would select a version of the assessment that spans a subset of the levels within the learning progressions that seems most appropriate for her students. The purpose of this assessment is to provide information that would locate or place individual students and groups of students on a network of levels with respect to the three learning progressions. This information will be helpful to the teacher as she begins planning next instruction steps. We envision that the locator test would be used only one or two times during a school year.

The incremental tasks are for classroom use by teachers, both to update teachers' understanding of where students are in their understanding and to support student learning as they transition from one level to the next within a progression. Each task explicitly targets a transition between levels, rather than the levels themselves. These tasks are designed for flexible classroom use and to support differentiated instruction since we expect students in any middle school class to be arrayed across multiple levels of a learning progression. As such teacher might draw on a much greater number of the incremental tasks to supplement instructional and assessment approaches throughout the year.

The use of learning progressions is still a relatively new idea for teachers. Tasks that target particular levels or transitions between levels, are therefore useful resource for teachers to use as part of their teaching and assessment processes. The tasks also serve to illustrate what student thinking or reasoning might look like at higher or lower levels of the learning progression. Together the tasks and learning progressions help teachers answer three questions that are essential to the formative assessment process (Ramaprasad, 1983; Wiliam, 2004):

- Where are my students headed?
- Where are the students right now?
- How can I close the gap between where they should be and their current location?

Learning progressions directly support the first two of these questions, and to some extent the third. In terms of understanding where students are headed, learning progressions provide both long-term goals through the full scope of the learning progression, and near-term goals by offering a way to characterize students' current level of understanding and the next appropriate step. Assessment tools built around learning progressions can then be used by both students and teachers to inform their understanding of students' current learning, and to plan instruction that can move their understanding along the progression. Finally, learning progressions can help close the gap between the students' current and intended learning by providing clear descriptions of the conceptual jumps needed to move between levels of learning. This articulation of

key ideas will help teachers identify what to do or focus on to close the gap between intended and current learning (Attali, Wylie & Bauer, 2012).

We consider this suite of assessment resources also to be an example of a "formalized tool" because it was developed outside the classroom, with teacher input, and it codifies important ideas about learning progressions. As in the previous example, teachers are able to select when and how to use the tasks to use in the classroom, whether to support whole class conversation or differentiated work with small groups working on related tasks that target different levels of the learning progression.

In conclusion, the fact that some summative tests have certainly been mislabeled or repackaged as formative assessments does not discount the role of formalized tools. We further argue that a "tool" is not synonymous with "test." A tool for formative assessment is merely an evidence gathering device, and it is up to the teacher to decide when and how to deploy which particular tool in any formative assessment context. In order to successfully augment the teacher- and student-led formative assessment process, any formalized instruments must be designed with teachers and students in mind. Expecting any assessment instrument to improve formative assessment is unrealistic. For example, simply because an assessment is administered frequently doesn't imply that it can provide value to the formative assessment process, especially if the instrument consists of items designed for summative purposes. Furthermore, adequate training and support for teachers is necessary in order for them to make effective use of the information from these instruments and incorporate it into their own instruction. In these ways, the formative assessment process can indeed likely gain from the additional information provided by formalized tools.

We presented two examples of formalized tools. Both examples codify what is being learned by cognitive scientists with respect to student misconceptions and how student understanding develops from naive conceptions to rich understanding. These tools can support the elicitation of student thinking and also can serve an educative role by communicating important ideas to teachers that they can use to inform instruction.

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