Formative Assessment and Instructional Intervention

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"Teaching without learning is just talking."
—Thomas A. Angelo and K. Patricia Cross, Classroom Assessment Techniques, *1993*[2]

The Challenge
For teaching to be effective, it must yield student learning—that is, a *change* in the student's cognitive or affective landscape. But how do we know whether this change has occurred? How do we know the teaching was effective, and what do we do if we find out that it wasn't?

To answer these questions, let's start by considering a familiar but seemingly unrelated experience: taking a road trip. Imagine that you've set out on Monday to drive from New York to Saint Louis. Your goal is to arrive in Saint Louis by Tuesday evening. You know from looking at maps that your destination is about 900 miles from your point of origin, so you plan to drive about half the distance on Monday and half the distance on Tuesday. Accordingly, you've decided to stay overnight in Zanesville, Ohio, which is halfway between your starting point and your desired destination. You've used this location as a benchmark to ensure that you meet your ultimate goal.

So, how do you ensure that you make your benchmark? For starters, you watch the mile markers and the clock; if you've only traveled 150 miles by late afternoon on Monday, you're unlikely to make to Zanesville unless you drive through the night. As you watch your progress, you might speed up or slow down depending on how you're doing. If you make it to Zanesville on time, you can feel assured that you're halfway to your goal, and you need to sustain your efforts the next day to arrive ultimately in Saint Louis at the time you desire.

What are formative assessments, and why use them?
What this analogy illustrates is the role that formative assessments play in successful teaching. Of course, you have ultimate goals for what students will learn. To test your success at meeting this summative goal, you need a summative assessment—final exam, culminating performance task, and so on. But it would be unwise simply to teach and hope that you arrive at that goal or to wait until the conclusion of the class to assess student learning. How do you know whether the students are "getting it," whether they are on the way to meeting the ultimate endpoint? What do you do if you find that they *aren't* understanding what you want them to? The answer lies in a pedagogical technique called *formative assessment*.

Formative assessments are pedagogical conventions that allow you to gauge student progress over the duration of a course (Angelo and Cross, 1993). They function like the mile markers in our road trip example: they show us how far we've come and how far there is to go. If I ultimately want students to understand, say, how to solve equations with more than one variable, I need to check their progress to attaining this goal—for instance, checking whether they understand how to isolate one variable. Educators can adjust their instructional approaches based upon the findings: if, for example, you check for understanding and discover that several of the students did not adequately grasp major concepts presented during lecture, you may offer additional office hours that week, retouch on that topic in the following lecture, provide additional support in online classrooms, etc.

Unlike summative assessments, which are final and assign a value to students based upon their performance, formative assessments offer opportunities for change or modified teaching approaches where necessary. Waiting

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until the end of a course to measure learning, which is when most summative assessments occur, means that opportunities for both students and instructors to reflect upon learning while there is still time to make necessary adjustments are lost. By contrast, checking for understanding in a non-evaluative, ongoing way means that course participants can become aware of areas where misunderstandings persist, content that is difficult and requires additional support for mastery, and other factors that may be obstructing truly successful learning.

What Instructors Can Do
Formative assessments come in various types. These are not designed not to assess students in order to grade or evaluate their performance, but rather to gauge the level of concept or skill mastery the student has attained. Using this data, teachers may choose from any number of instructional interventions—supplementary materials, additional lectures on a topic, student support from teaching assistants, etc.—to foster increased student learning where necessary.

Fig. 1: Some examples of formative assessment

Technique	Description	Yield
Exit slip/ticket	Asks brief questions about content; opportunity for diverse questioning	Awareness of student comprehension; ability to gauge what is still unclear or what questions remain
Low-stakes or anonymous quizzes	Similar to traditional quizzes, but not intended to assign student a grade	Data on development of content and skills mastery
Pass/Fail response papers or double-entry journals (with or without guiding questions)	Papers that document students' interaction with texts, guest lecturers, etc. (Double-entry journal allows for instructor to respond)	"Transcript" of student thought processes; ability to track comprehension of key ideas, areas of misunderstanding, etc.
Audience Response Systems (ARS)	Supported by software such as TurningPoint; instructor asks question to check for understanding and students respond using wireless "clickers"	Real-time data on overall class comprehension; responses are anonymous and students cannot be influenced by others' responses

It is important to note that many instructors use anonymous formative assessments, a technique with many advantages: student performance is less likely to be affected by anxiety, students can feel confident that honest responses will not be held against them in a graded way, and so on. However, when non-evaluative, ungraded formative assessments become part of the culture of your classroom, students will be less anxious even when assessments are not anonymous; moreover, they will begin to view this ongoing process as an opportunity for them to reflect upon their own learning and determine their next steps to meet the course's learning goals.

In addition, non-anonymous assessments offer greater awareness for the instructor of *who* is "getting" *what*, allowing the instructor to target their interventions. For instance, let's imagine that a formative assessment reveals that student John Doe has mostly grasped regression analysis but is still struggling with cases involving location parameters. Dr. Smith, the instructor, may choose to offer John additional materials to support his understanding, email him more problems of this type, invite him for office hours, direct the Teaching Assistant to support John, and so on. On the other hand, if Dr. Smith learns from an anonymous formative assessment that 93% of the class population grasps the major points of location parameters, she still has no greater awareness of *who* is struggling with this concept and how to target these students for additional support in this area.

Conclusion
Formative assessment is a powerful tool instructors can use to structure their teaching and track student progress. By taking continuous, non-evaluative measures of learning and making adjustments to teaching where necessary, educators can increase the likelihood of reaching their ultimate instructional goals. Embedding formative assessments into the fabric of course design allows both faculty and students to reflect upon learning and to determine their next steps to achieve