

# Using **FORMATIVE AND ALTERNATIVE ASSESSMENTS** to Support Instruction and Measure Student Learning

by *Tricia Britton*

**H**ow many of us assess our students only summatively, using these assessments to assign grades? I know I did. And while I continue to employ the traditional chapter test as a summative assessment, it is only one of a variety of ways I evaluate student learning and assign grades. This article describes how I use homework, “three quick questions,” trivia questions, pretests, and practice tests to formatively assess student knowledge and direct instruction. Additionally, alternative assessments and a science-project paper are means by which students demonstrate mastery of skills not easily assessed by traditional objective tests.

## **An early attempt: The practice test**

For a number of years, I used the traditional chapter test for the primary purpose of assigning a grade to each student. After the test, there was no going back; regardless of how students performed, the class moved ahead. Struggling students usually fell further behind, as knowledge from one chapter was needed for success in the next. Using the test results as data to help “make instructional decisions” (Popham 2001) never entered my mind. But the plight of the struggling students bothered me, and I looked for a way to help them before, rather than after, the test.



Using formative assessment involves gathering data from students on their progress and comprehension so that instruction can be adjusted to meet their learning needs (Popham 2001; Greenstein 2010). My first attempt at formative assessment involved using results of a practice test to direct review. I used the term “formative assessment” with students, instead of calling it a practice test, to help students understand I would use the evaluation for data collection only.

The formative assessments were distributed at the start of class, and students answered as many questions as possible. Correct answers were provided to students, who were expected to not just correct their mistakes, but to make it obvious if an answer had been corrected. I collected these papers, tallied which questions needed corrections (Figure 1), and returned them to students for studying. These assessments were not graded, so I was able to quickly tally the results of a class set of papers. When many students missed a question, I knew I needed to review that particular concept.

These assessments were useful both to students and to me. Analysis of the data revealed to me collective gaps in comprehension, and individual students were made aware of the gaps in their understanding. As seen in Figure 1, some concepts were more difficult for students to easily grasp, making further review and more practice a necessity.

The review session was a day or two after the practice test to allow students time to study the content and formulate their questions. I used the tallied results obtained from the practice test to plan the review session. Before beginning the review session, students were given an index card on which to write their questions, and I started the review by answering some of these questions. For students who understood the concepts, the review provided an opportunity for deeper understanding, because these students were called upon often to address misconceptions and misunderstandings of their peers. By the end of class, all questions had been answered.

## The pretest

After using this formative assessment method for a few months, I noticed that for the majority of students, test scores on the end-of-unit summative assessments were higher than before I started using the formative assessments. I also noticed that a few of my students, while their test scores were higher than before, still earned low test scores. Their gaps in understanding

were too large, or revealed too late to develop proficiency. Conversely, there were other students whose comprehension was high from the start of the chapter, and it was sometimes difficult to keep them engaged in classroom activities.

I needed to know which students had prior knowledge of chapter concepts, and what misconceptions or misunderstandings students held. To answer these questions and direct my instruction, I now administer a pretest. Initially, I returned the pretests after tallying the results. Now I keep them and redistribute them for use as the practice test. I also use these data when grouping students for activities—students with prior knowledge become peer tutors of the groups.

This practice and rehearsal is not teaching to the test, it is a means for students to practice and rehearse their understanding of new concepts. It is only fair to make students aware of the content on which they will be assessed, and the pretest and practice-test questions are not the questions used on the summative assessment.

## “Three quick questions,” labs, and homework

Waiting until the end of the chapter before doing any type of formative assessment is not productive. During this time, struggling students can lag behind to the point that it may be too late to help them catch up. To avoid this situation, there are a few techniques I use at various times during each chapter’s instruction to assess student understanding. The first technique is something I call “three quick questions.” Before students enter the room, I write three questions on the board based on the content of the last few days. When they enter, students are given index cards on which they write both the questions and their answers. I collect the cards and mark each question as correct or incorrect. Individual scores are recorded in the grade book, but these scores are not used in grade calculations. The cards are returned, the correct answers are provided, and students keep the cards as a study aid. I use the data to identify students who need a help/study session. If most miss a question, this concept is reviewed or retaught to the entire class. This assessment requires only a small amount of time; even in a class of 30 students, the three questions can be quickly assessed and marked.

Lab activities and homework assignments are also used as formative assessment. I collect students’ work

**FIGURE 1** Teacher's tally of formative assessment data

	(A)	(B)		(A)	(B)
7A			23. What is terminal velocity? Explain which forces are balanced?	7B	
A			top velocity reached during free fall	A	
B			weight force down = + opp to air resistance	B	
A-1			24. What is Newton's 2 <sup>nd</sup> Law? Why does it describe circular motion? How is there force acting on an object moving in circular motion at a constant speed? What would the force be if it were not moving in a circle?	A-11	
B			$F = ma$	B	
C			acceleration = $\Delta$ speed and/or direction.	C	
D			circular motion always $\Delta$ in direction so	D	
A-11			even at constant speed. have acceleration + so	A-11	
B-11			there is a force (centripetal) acting on the object	B-11	
C-11			no circle + constant speed = 0 N.	C-11	
D-11			25. Identify the reaction in each of the following actions:	D-11	
A-11			a. foot pushes against the earth:	A-	
B-1			earth pushes foot	B-11	
C-1			b. weight against the floor when you are standing:	C-1	
			floor against weight		
			c. you hit a wall with your hand:		
			wall hits hand		
A-111			26. You have a weight of 640 N on earth. What is your mass on earth? On the moon? ( $g=1.6 \text{ m/s}^2$ ) Be careful!	A-1111	
B-1			Weight = mass $\times$ gravity	B-11	
			$640 \text{ N} = m \times 9.8 \text{ m/s}^2$		
			$= m$ mass doesn't change		
			27. What force must be applied to a 15 kg object to make it accelerate $5 \text{ m/s}^2$ ?		
			$F = 15 \text{ kg} \times 5 \text{ m/s}^2$		

all  
okay

**FIGURE 2****List of possible products for alternative assessment assignment (Campbell, Campbell, and Dickinson 2003)**

Examine the list below. You have many options to choose from to demonstrate your knowledge. If you think of something different, please discuss it with me. Use the study guide for key ideas and vocabulary that should be included in the project. Let me know what you choose to do. Attached is a rubric I will use to evaluate your product. Be creative! Let your intelligence shine!

- Write lyrics for a familiar tune.
- Express concepts musically and explain the connection between the instrument (or musical pieces) and the content.
- Design a web page.
- Make a flowchart and be prepared to explain it.
- Create a concept map/web.
- Make a brochure.
- Write a story.
- Create a PowerPoint presentation.
- Make a 3-D model.
- Write a newspaper article or news broadcast.
- Write a play and act it out.
- Record a video.
- Make your own test with answer key (you will need lots of questions).
- Construct a mobile.
- Write an essay.
- Make a collage.
- Design a poster.
- Make a painting.
- Record an audio tape.
- Write a speech.
- Give a lecture.
- Write a poem.

and read each answer, looking for misconceptions in students' responses, which are addressed at the time the homework is returned to them in class. This can be direct instruction or discussion about the misconception followed by clarification of the concept. There are a few students who need reteaching or reinforcement of concepts more frequently than others in the class. These few students are required to attend help sessions, where they are provided with extra instruction and review as needed, and are supervised while they redo the homework assignment.

## Alternative assessments and rubrics

I sometimes use alternative assessments for demonstration of content knowledge. Students choose how they want to show their learning from a list of possible products (Figure 2), which is distributed along with a list of chapter objectives that must be met and displayed in the product. PowerPoints are a popular choice; some students create mobiles; others write a story or design a comic book (Figure 3).

These nontraditional products are evaluated using rubrics, which are easy to design; an internet search yields many sites that specialize in rubric design. Students are given the first column of the rubric—these are requirements for “A” work; they do not get to “choose” to work for a “C”—to ensure that they know what is expected of them. It is also posted on the electronic homework site.

Student work is evaluated with a hard copy of the entire rubric in hand (Figure 4), and work is returned with this rubric. Learning and using new skills proficiently requires practice. Providing time for editing and revising provides the practice necessary for learning. Help sessions are available to those who may need it. Students can demonstrate the depth of their understanding through oral explanation of their product followed by a question-and-answer period.

## Science-project paper

There is more to be learned in science class than the concepts on which students are tested, including skills such as experimentation, data collection, and graphing. Developing science literacy involves reading scientific materials and writing scientifically. According to Popham (2001), “if we want to find out if students are capable of using a skill in a variety of settings, we must measure mastery of the skill in a variety of ways and teach students to demonstrate mastery in those various ways.” On the traditional chapter tests, students demonstrate their mastery of concepts. The science-project paper is the vehicle through which students can first practice and then demonstrate their learning of these skills and development of science literacy.

For this paper, students think of a question that can

**FIGURE 3** Student mobiles created as alternative assessments



be answered through experimentation. They research the literature and form a hypothesis that is then tested by way of an experiment. After data collection, graphing of the data, analysis, and conclusion, students submit a science-project research paper—the sum of all the parts. The science project asks students to demonstrate mastery of scientific research methods including researching; writing; collecting, organizing, and graphing data; analyzing; drawing conclusions; and displaying results of their individual research. Rubrics inform students of expectations of each section of their science-project research papers. Revisions provide the opportunity for practice and learning of these skills before a final grade is given.



**FIGURE 4** Rubric used for evaluation of alternative assessment

Category	8 points	6 points	4 points	2 points
Amount of information	All concepts are addressed.	Most concepts are addressed.	Some concepts are addressed.	Few concepts are addressed.
Quality of information	Information clearly relates to the main topic and requires thorough understanding of concepts.	Information clearly relates to the main topic and requires some deeper understanding of concepts.	Information clearly relates to the main topic and requires a surface understanding of concepts.	Information has little or nothing to do with the main topic.
Category	4 points	3 points	2 points	1 point
Organization	Information is very organized and matches format of choice.	Information is organized and matches format of choice.	Information is organized but does not match format of choice.	Information is disorganized.
Mechanics	No grammatical, spelling, or punctuation errors.	Almost no grammatical, spelling, or punctuation errors.	A few grammatical spelling, or punctuation errors.	Many grammatical, spelling, or punctuation errors.

## Conclusion

I want all my students to experience success in science. That success is learning, with grades used as an indicator of knowledge. Learning must be monitored, and formative assessment is a process, not an end product (Lyver 2008). Used effectively, formative assessment monitors student learning.

Pretests are formative assessments that locate misconceptions, misunderstandings, and prior knowledge so that an effective and efficient instructional plan is designed. To maximize the learning experience, homework, lab activities, and three quick questions provide the information needed to ascertain student comprehension at any point during a chapter's instruction. At chapter-test time, a practice test used as a formative assessment reveals any remaining gaps in comprehension and helps direct the review session. Finally, alternative assessments and the science project

allow students to demonstrate in various ways mastery of skills and concepts learned. ■

## References

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