Assessment Defined

Assessment is a tool for understanding what students are learning. Many instructors know intuitively that assessment is integral to teaching—that students learn from preparing for and taking exams. The philosophy of this chapter expands upon that knowledge. If students learn from taking exams, and we discover what they have learned by grading the exams, then why wait for the exam to test them? Both students and instructors benefit from the results of regular, ongoing assessment when it is used to “promote and diagnose” learning (Huba and Freed 2000). In short, “assessment is more than grades . . . it is feedback for students and instructors . . . and it drives student learning” (National Institute for Science Education 1999a).

Why Assessment?

Assessment should seem natural to scientists because it parallels parts of scientific research. In science, data collection is central to discovery; in scientific teaching, instructors collect data to evaluate teaching and learning. The information generated by assessment is crucial because it informs change, making assessment the fulcrum of scientific teaching. Assessment is omnipresent in arti-
cles about undergraduate science education; journals like *CBE-Life Sciences* and *BioScience* explicitly include assessment among their submission requirements. Furthermore, recent publications demonstrate that scientists have successfully integrated assessment principles into their teaching (Udovic 2002, Ebert-May 2003, Knight and Wood 2005).

The literature about assessment includes a breadth of accessible and useful resources. In 1993, Angelo and Cross compiled *Classroom Assessment Techniques: A Handbook for College Teachers*, a compendium of teaching methods and examples for incorporating assessment into college classrooms. Six years later, Huba and Freed (2000) wrote *Learner-Centered Assessment on College Campuses: Shifting the Focus from Teaching to Learning*, an assessment resource that explicitly focuses on learning. These two resources, among others, have guided how college instructors approach assessment for the past decade.

**Ongoing assessment increases learning gains**

Assessment has the obvious purpose of monitoring learning, but the consequences are more profound from the student perspective when it is used to promote learning. In an extensive review of research about assessment in the classroom, Black and Wiliam (1998) concluded that ongoing assessment plays a key role—possibly the most important role—in shaping classroom standards and increasing learning gains. They reported that well-designed, regular assessment of students had more impact on student learning than any other educational intervention. In addition, they found that high-caliber formative assessment increased learning gains for all students, but it had the most impact for low-achieving students. According to Black and Wiliam, "formative assessment . . . is at the heart of effective teaching." Thus, assessment—the process of determining progress toward and achievement of goals—is an essential component of quality instruction.

> "Ongoing assessment plays a key role—possibly the most important role—in shaping classroom standards and increasing learning gains."
> 
> Black and Wiliam, 1998

Assessment tools that provide regular checkpoints and measures of achievement let the students determine whether they are on track and accordingly
modify their approaches. Specifically, regular, ongoing assessment provides a mechanism for students to evaluate themselves and each other. As a result, learning becomes a process of reflection and analysis with specific markers of achievement, rather than simply an end point and a grade. The resulting information helps guide changes in student study and learning behavior.

Assessment provides feedback to students and instructors about learning

According to Wiggins and McTighe (1998), there are two important features in assessment: (1) what kind of performance or behavior indicates understanding, and (2) what specific criteria differentiate the levels of understanding. In other words, assessment relates to two aspects of students performance: what students do and the caliber of their performance. The part that students do is simply the activity in which they are expected to participate. The caliber of performance deals with how well the students perform the activity. For a multiple-choice question with a single, correct answer, this is clear: A correct answer indicates excellent performance. However, more complex projects that involve writing or presentation can be trickier to evaluate. In this case, it helps to have a mechanism for defining excellence. Rubrics can be powerful tools to help students achieve excellence, and to keep instructors focused on their goals.

The primary feature of assessment is that it provides feedback to instructors and students about learning and teaching. When assessment is integrated into the learning process, students learn to differentiate between what they already know and what they need to learn, which helps focus and motivate learning. Assessment is typically categorized in two ways: formative and summative. Both formative (during the teaching event) and summative (at the end of the teaching event) assessments offer information about student learning that can shape learning behaviors and guide instructional decisions.

Feedback to students

When assessment is routinely integrated into the curriculum, it provides a mechanism to engage students and shape their learning behaviors. In Chapter 1, we described the importance of metacognition—the ability to carry on an internal dialogue about what is being learned. Assessment allows students to gauge their own progress toward the learning goals and provides the feedback they need to prompt changes in their study habits. Feedback from the assess-
ment activities, therefore, becomes an integral part of the learning process instead of just a checkpoint at the end of a unit or semester.

**Feedback to instructors**

From the instructor’s perspective, assessment data should guide changes in instruction, curriculum, and teaching behaviors. Effective assessment informs instructors how students are progressing toward learning goals while the learning is occurring. The feedback from assessment guides mid-course instructional changes that can help redirect students toward the learning goals. In addition, assessment tools provide more than grades; the results can promote dialogue between students and instructors and guide changes in instructional materials and teaching. As one educator explained, “For teachers to be effective in achieving learning goals, they must engage in an ongoing process of aligning the content, themselves, and students in a specific context” (Wulff 2005). Whether it’s a prequiz about prior knowledge, a homework assignment, a midterm exam, or an in-class activity, the time the assessment takes should be consistent with the relative importance of that knowledge or skill set as a learning goal.

Simple assessments can help guide instructional decisions. For example, a brainstorming activity can elicit students’ prior knowledge about a topic through a series of questions that students answer with an audience response system (“clickers”). If the results indicate that most students already know the topic, then the instructor may elect to skip the topic, probe deeper to determine how much they know, conduct a brief review, or delve into an application of that topic that requires more complex analytical skills. If the material is new to the students, or they have misconceptions about it at the beginning of class, then the instructor might consider revisiting the same question(s) again at the middle or end of class to see if their understanding has improved. If understanding does not improve, the instructor should consider why and decide what teaching action to take.

Activities can likewise provide qualitative data if students have the chance to convey what they feel is most effective, what they like/dislike, whether they feel the learning objectives are being met, if they like working in groups, whether they struggle to understand, or how the instructor might improve teaching and learning. Feedback from these types of questions can help quantify some of the more intangible aspects of teaching and serve as a mechanism to improve instruction. Moreover, students’ investment increases when they are given a chance to make decisions about their own learning.
Assessment and diversity

It is important for the instructor to cultivate an environment in which all students have ample opportunity to gauge their progress toward the learning goals during the learning process (National Institute for Science Education 1999a). In addition to increasing learning gains, assessment can help foster inclusive classrooms. Shifting the emphasis from criticism to constructive feedback can foster open dialogue in the classroom. This creates a classroom climate that is respectful and welcoming, yet clearly focused on learning. In addition, feedback from a variety of assessment methods can help a diversity of students take responsibility for their own learning in their own ways. The effect is to catapult learning beyond facts and figures and to create an inclusive classroom where students come to understand the complexities of science as well as the process of learning science.

A word about grading

The reality of most courses is that, at the end of the semester, instructors need to assign a grade. This is where assessment becomes evaluation. While assessment activities provide the instructor and student with ongoing feedback about student understanding, a second type of assessment—summative assessment—measures progress at defined points in the semester. A well-designed assessment plan should lend itself readily to grading. Students should have a clear vision of what the instructor expects in terms of knowledge, skills, and performance, and they should have a fair amount of experience assessing their learning (and that of their peers) at many points during the course. Summative assessment helps gauge how well the students have learned the material and supplies data that can be converted into a grade. Examples of summative assessments include any of the classic midterm or end-of-semester activities: comprehensive exams, final oral presentations, or poster symposia. The important point to remember is that assessment is more than grading; it offers ongoing feedback to students and teachers alike.
Assessment in Practice

"EnGauge" students in learning

Active learning exercises—such as those described in Chapter 2—and assessment tools converge. It is hard to imagine an active learning exercise that does not have an assessment component, and assessment is automatically active because the students must do something to assess themselves or be assessed. Many assessment tools, therefore, resemble active learning activities and accomplish similar goals. It is worth considering them in both contexts to understand their multiple roles in teaching and learning.

We have coined the term "enGauge" to capture the spirit of scientific teaching: students simultaneously engage in learning and gauge what they are learning. Engaged students are more motivated to achieve the learning goals and take responsibility for learning (Marzano 1998), which is precisely the type of academic curiosity that effective science courses aim to awaken (National Research Council 2003).

A well-designed enGaugement motivates all students to learn and provides instructors and students with feedback about learning. Because it integrates the three core themes of scientific teaching—active learning, assessment, and diversity—an enGaugement can simultaneously engage students and gauge their learning. EnGaugements are particularly effective at addressing difficult concepts or skills, targeting common misconceptions, or emphasizing important points. Many enGaugements also lend themselves well to grading. Table 3.1 provides a list of "enGaugements."

Enlist students in teaching each other: Reading assessments

Reading assessments are one of the most comprehensive examples of scientific teaching, because they target diversity, active learning, and assessment at many levels. The previous section provided ideas for instructors to "enGauge" students. Reading assessments take enGaugements one step further by enlisting groups of students to design the activities and teach each other. At different points in the course, each student group designs and leads an activity about an assigned reading. The goal of each reading assessment is twofold: to engage
everyone in learning and to determine whether everyone in the class understands the reading.

Reading assessments are inclusive by design. They give students freedom to design an activity that makes sense to them—and their individual learning styles and preferences—within the constraints of format and time. Students work in groups toward a common goal, so they get all the benefits of cooperative learning, peer teaching, and diverse group dynamics. Over the course of a semester,

<table>
<thead>
<tr>
<th>Tools to Engage Students</th>
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</thead>
<tbody>
<tr>
<td><strong>Brainstorming</strong></td>
</tr>
<tr>
<td>List as many answers as possible to a question.</td>
</tr>
<tr>
<td><strong>Case studies</strong></td>
</tr>
<tr>
<td>Solve a problem or situation in a real-world context.</td>
</tr>
<tr>
<td><strong>&quot;Clicker&quot; questions</strong></td>
</tr>
<tr>
<td>Answer questions electronically in class.</td>
</tr>
<tr>
<td><strong>Decision making</strong></td>
</tr>
<tr>
<td>Work together to recommend solutions to a problem.</td>
</tr>
<tr>
<td><strong>Group exams</strong></td>
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<tr>
<td>Work together to discuss exam questions but write answers individually.</td>
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<tr>
<td><strong>One-minute papers</strong></td>
</tr>
<tr>
<td>Write a short answer about a topic or question.</td>
</tr>
<tr>
<td><strong>Pre/post questions</strong></td>
</tr>
<tr>
<td>Answer questions before and after a topic is taught.</td>
</tr>
<tr>
<td><strong>Strip sequence</strong></td>
</tr>
<tr>
<td>Arrange a series of events into the correct order.</td>
</tr>
<tr>
<td><strong>Think-pair-share</strong></td>
</tr>
<tr>
<td>Think about possible answers to a question individually. Discuss them with a partner and come to consensus.</td>
</tr>
<tr>
<td>Biology Example and Instructions</td>
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<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td><strong>Brainstorming</strong>&lt;br&gt;Answer the following question in large group. One person records answers. Optional: Arrange the list into two or more categories (e.g., abiotic vs. biotic factors)&lt;br&gt;<strong>Question:</strong> What does a plant need to survive?</td>
</tr>
<tr>
<td><strong>Case study and decision making</strong>&lt;br&gt;Read the following case. Write a paragraph to explain what the patient should do next. Justify your recommendation with biological reasons.&lt;br&gt;<strong>Case:</strong> A patient expressed eye irritation, which the doctor diagnosed as conjunctivitis. Antibiotic treatment alleviated the symptoms within a few days, but the symptoms returned two weeks later. The doctor recommended taking antibiotics again.</td>
</tr>
<tr>
<td><strong>“Clicker” questions</strong>&lt;br&gt;Answer the following question on your electronic response keypad.&lt;br&gt;<strong>Question:</strong> Which organisms are most distantly related? (a) bacteria and archaea; (b) plants and animals; (c) plants and fungi; (d) humans and fungi.</td>
</tr>
<tr>
<td><strong>Group exams</strong>&lt;br&gt;Work with a group to discuss the following statement. Write your answer individually.&lt;br&gt;<strong>Statement:</strong> Explain the role of aflatoxin in liver cancer.</td>
</tr>
<tr>
<td>Biology Example and Instructions</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td><strong>Mini-map</strong></td>
</tr>
<tr>
<td><strong>One-minute paper</strong></td>
</tr>
<tr>
<td><strong>Pre/post questions</strong></td>
</tr>
<tr>
<td><strong>Strip sequence</strong></td>
</tr>
<tr>
<td><strong>Statement correction</strong></td>
</tr>
</tbody>
</table>

**Terms:** tRNA, DNA, protein, mRNA, amino acid, translation, transcription, replication, promoter

**Question:** What about the structure of DNA suggests a mechanism for replication?

**Statement:** Describe two mechanisms that a bacterium can use to harm a plant.
the diversity of activities will illustrate many ways to approach a complex topic or difficult reading.

The nature of reading assessments is active and collaborative. Reading assessments require cooperation by the students who develop and teach them, and everyone benefits from the active-learning environment when they are engaged in the activity during class. Reading assessments also foster deep learning. The presenting groups have to employ several high-order thinking skills to develop an activity. They evaluate which aspects of the reading are most important, choose which topics to include, and design an activity to assess and engage their classmates' understanding of the reading.

Finally—and arguably most importantly—reading assessments gauge how well students understand the reading and its concepts. The instructor can use the feedback to grade the presenting group or as formative assessment about how well students understand the reading topic. The feedback can provide information for students as well. Everyone in the class has a chance to question their own understanding of the reading through the activity, and the presenting group will have had to determine whether they understood the material in sufficient depth to teach it.

One of the best outcomes of reading assessments is that students actually do the assigned readings (and every instructor knows how difficult it is to enforce reading assignments!). If students choose not to read before class, they will not be able to participate in the discussions, and they will let their peers down. It is therefore important that the readings are difficult enough that students struggle with them and come to class with questions about the readings and are ready to engage in learning more.

Many instructors have reservations about turning over so much control to the students. What if the student presenters say something wrong, and the whole class graduates from college thinking that DNA is always single-stranded? Part of the power of reading assessments is they are designed to uncover misconceptions, and if one student is thinking it, many others probably are too. The odds are very good that someone in the group will catch the mistake and correct it because students are working in groups. This can also be a teachable moment: an opportunity to correct the mistake for the entire class. (Chapter 2 has more suggestions for how to deal with “wrong” with empathy and panache.)

Finally, no matter what activity the students design, every instructor should have a back-up plan and a little bit of summary time to discuss alternative views
on the main points of the readings, address important information that was not included, underscore key concepts, or correct any remaining misconceptions. However, this time should not be used to cover every bit of content from the reading. Remember that the students should have already read it and have just spent time discussing it. This time should be used to ensure that students understand the key concepts; they can use the reading to fill in the details.

Measure both progress and outcomes

Assessment measures both progress and outcomes, which ties closely to the learning goals—what students will know, understand, or be able to do. If a topic, skill, or behavior is important enough to represent a learning goal, then students’ progress toward the goal should be assessed. Assessment reinforces each goal’s importance and provides students with a framework for gauging progress toward achieving it. Alignment is the key to reducing curriculum clutter and alleviating the nagging sense that you have to “cover everything.” To do this, assessment must align with learning goals and communicate clear standards of “excellent” performance. In sum, assessment engages students in learning and enables both students and instructor to identify gaps, confusion, mistakes, and progress. Close alignment of assessment and learning goals helps simplify decisions about what to include and what to jettison, and to set clear expectations.

In Table 3.2, the activity assesses knowledge at three key points: at the beginning of the lab (students have to recognize what they don’t understand about bacterial cells and growth when they make a prediction), during the lab (students have to decide what to measure and record), and at the end of the lab (students have to explain what a colony is in order to explain whether their evidence supports the hypothesis). In addition, this assessment can be used to test several other learning goals, such as the ability to design a controlled experiment with replication, to understand the concept of microbial diversity, or to work collaboratively in groups.

Give exams that foster learning

One of the most surprisingly effective ways to assess students is group exams. It is surprising because most of us have been taught that exams must be individual,
Instructions for Reading Assessments

Work in groups of 2-4 students to develop a 20-minute reading assessment based on the assigned reading. A reading assessment replaces lecture, so the activity needs to engage everyone in the class, give context to the reading in relation to the course, and give everyone time to learn actively. On the assigned day, your group will lead the activity. Everyone in the group should be involved in development of the reading assessment and in teaching it in class. Some examples are listed below.

Each reading assessment should:

- Engage everyone in the class in an activity based on the assigned reading
- Determine how well each student understands the main concepts and topics from an assigned reading
- Apply the reading to the relevant topics in this section of the course
- Be creative

Sample Reading Assessments

1. Write three questions that you have about the reading. Discuss solutions in small groups for five minutes. Each group will report one question and its solutions to the large group.
2. List two things you learned from this reading. Explain how each could be applied to another topic in this course.
3. State what you think were the author’s main points.
4. Explain how you could use a scientific method or technique from the reading.
5. Answer a set of questions that highlights the most challenging aspects of the reading (in a worksheet or quiz format).
6. Identify which terms are integral to understanding the main points of the reading. Sketch and describe the relationship among the terms.
7. Compare and contrast the ideas in the reading with a manuscript, book, data set, or website.
8. Answer the following questions. What hypothesis or hypotheses were the authors testing in this paper? What evidence did they provide to support or refute each hypothesis? Was the evidence convincing? How did the experimental design and methodology test each hypothesis? How did the data analysis illustrate the authors’ points?
9. Identify how the key concepts of the reading fit into a larger assignment such as a term paper, group project, or end-of-semester presentation.
10. Write a response to the authors of the assigned manuscript. The letter should summarize the manuscript’s key points; describe how the research contributes to science; laud any novel, interesting, or rigorous aspects of the research; describe the strengths in the experimental design or data analysis; and provide suggestions for improvement or future research.
11. Write a 100-word abstract for the reading. Discuss.
12. Identify the contentious issues in the reading and debate them.
13. Answer a question about the reading. Share answers with the large group and discuss.
14. Compare/contrast: Explain how this reading is similar to or different than something that was discussed previously.
competitive experiences to measure learning. If, however, our goal is to promote learning, instead of just measuring it, we must consider the value of group exams. Group exams are most effective with open-ended, complex questions that do not have right or wrong answers. The group process, interactions among students, and vigorous debate are intensified by an exam structure and the grade associated with it. These can be used to generate creative ideas and build the critical and logical thinking skills needed for biology. Students are willing to tackle much more difficult problems in groups than they will attempt individually (Johnson and Johnson 1975, Duren and Cherrington 1992). We find that students respond best to being required to work with a group but then to generate a written answer individually for which they receive an individual grade. This approach capitalizes on both group process and pride in individual accomplishment. To ensure that students understand and adhere to the rules, they can be asked to provide a list of their group members and to sign a “contract” that states the rules of conduct clearly. (See Figure 2.4 “Expectations.”)

<table>
<thead>
<tr>
<th>Learning Goals</th>
<th>Learning Outcomes</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>At the end of this lab, students will understand that bacteria are ubiquitous, microscopic organisms whose populations are difficult to measure.</td>
<td>Students will be able to explain what happens during the formation of a bacterial colony on an agar medium. Students will be able to explain why, based on the colonies that appear on the agar medium, they can arrive at only an incomplete estimate of bacterial populations in natural environments.</td>
<td>Predict-observe-explain: Students are given three Petri plates containing agar medium and are asked to use the materials to demonstrate that microbes are ubiquitous. First, they predict what will happen, then observe the results and explain how the results support or refute the hypothesis. <strong>PREDICT:</strong> Touch an agar medium with your fingers and predict what you’ll see in a week. <strong>EXPLAIN:</strong> Explain your prediction. Why do you think this will happen? • <strong>OBSERVE:</strong> A week later, observe and record any changes. <strong>EXPLAIN:</strong> Did the observations match the predictions? Explain why the observations do or do not support the hypothesis. Are all of the bacteria on your fingers represented on the agar medium? Why can’t you see the bacteria on your fingers but you can see them growing on agar medium?</td>
</tr>
</tbody>
</table>
Set clear expectations: Rubrics

It should be clear to students how achievement of the learning goals will be measured, what outcomes (behaviors or levels of performance) are expected, and which assessments will be used for grading purposes. One way to provide students with a clear explanation of expectations is to prepare a detailed rubric. A rubric is a framework that dissects each aspect of an assignment and describes the components that are expected for various levels of achievement. Most significantly, rubrics are provided at the time the assignment is given. Huba and Freed (2000) claim that "rubrics explain the scoring 'rules': the criteria against which student work will be judged. More important, they make public key criteria that students can use in developing, revising, and judging their own work." They are helpful to students, instructors, and graders.

Example of a take-home exam for a biology course

Instructions: You are required to work on this section of the exam with other students in this class. List the members of your group above. After you have discussed the questions with others, compose your answer by yourself (typed). Do not write the answer as a group. Do not copy the answer from another student. Writing the answer as a group or reading or copying another student’s answer is cheating and is not permitted in this class.


1. Explain the relationship between stored grain, fungi, aflatoxin, and liver cancer.

2. The 249th amino acid in the p53 protein is normally arginine. While researching cancer in liver cells, scientists found that DNA mutated in the 249th codon produces a p53 protein with the amino acid serine at that position. Write the changes in the DNA and mRNA that lead to this change in the protein.

3. Whether or not a chemical causes cancer can be tested in many ways. In one method, chemicals are fed directly to animals, then researchers assess whether or not the animals develop tumors. Another approach is to conduct an "Ames Test" which tests the ability of chemicals to cause mutations in bacteria. The Ames Test is based on the assumption that mutagenicity is associated with carcinogenicity, and the data it generates on mutation rates is used to predict how likely a chemical is to cause cancer. Conduct a virtual Ames Test experiment (http://scientificteaching.wisc.edu) to address the following hypothesis: Aflatoxin is a mutagen. Describe in detail the methods and results of your experiment. Discuss your conclusions.
Rubrics and students

Rubrics educate students about the standards they are expected to achieve. Rubrics can provide a clear articulation of scientific norms and language. A rubric can demonstrate conventions for writing a testable hypothesis, making clear that it is neither prediction nor theory. Students can use rubrics as a guide to evaluate their own progress and as a tool for reviewing each others' work. They can be used to evaluate individual assignments or progress toward the goals of the entire course. For individual projects, the rubric might focus on clear descriptions of what students should know, understand, and be able to do that are related specifically to that material. For evaluation of progress toward course goals, the rubric is more likely to stress overall skills and knowledge that should be gained by the end of the course.

Rubrics and instructors

Instructors can use rubrics to hold themselves to teaching according to the principles of backward design. (Refer to chapter 5 for more information.) A good rubric clearly states the learning goal and then delineates levels of achievement and how they will be judged, reminding the instructor to start with goals and work backward from there. Grading with a rubric provides information about teaching and learning achievements that can be used to guide future instructional decisions and to serve as evidence of the caliber of teaching. In addition, rubrics make transparent to colleagues the instructor's intentions, which can open lines of communication and foster discussions about teaching-related issues. Rubrics can also remove the directive voice that typically characterizes the instructions for assignments or projects. The nonauthoritative tone of rubrics sends a message that it is the student's choice to do excellent work, or intermediate work, or not to do the work at all rather than sending the message that the only correct approach is to follow the instructor's orders.

**Assessment drives student learning,** so rubrics should guide students to the prioritized goals. Terms should be descriptive, explaining clearly the characteristics or qualities expected for each level of performance. Similarly, descriptions should be qualitative, not laden with value judgments or comparisons. Many rubrics also include a statement about the consequences of each performance level. Terms should also define the highest caliber of performance, such as "com-
prehensive," "complete," "sophisticated," "exemplary," or "excellent." Regardless of which is used, each term warrants a complete description of its unique qualities. Intermediate or lesser performances deserve the same attention as exemplary performances; simply reducing the quantity of incidents is not effective or informative. Rather, a well-designed rubric articulates the qualities and consequences that characterize typical performances at each level. Consistent with scientific teaching, rubrics are iterative in nature. A good rubric is a work in progress, adjusted for context, students, and instructor goals.

Rubrics and grading
Rubrics can make grading more objective and straightforward. Many rubric categories, such as the "accuracy of information," are best shared with students because they make expectations explicit and grades less of a surprise to students. Rubrics may need to be amended for grading purposes. To be sure that graders adhere to the same standards, it may be important to include information in the grading rubric that should not be in the rubric provided to students because it is information that they should discover for themselves. For example, the specific knowledge students are intended to learn might be excluded. The effort of preparing such a detailed rubric can save time later on because grades will be consistent and appear more fair to the students.

Rubrics—an example
The examples in tables 3.3a and 3.3b are based on an activity in which students write a four-page report to propose a new genetic engineering technology to the Food and Drug Administration (FDA). One criterion, accuracy of information, is compared between the two rubrics. Most rubrics would contain other criteria as well, depending on the goals of the activity.

The first rubric does not describe the type of errors that are being assessed (factual), nor does it differentiate among errors of different magnitudes (significant vs. minor errors). In contrast, the second rubric includes both explicit descriptions about the type of qualities that typify each level of performance and brief statements about the potential consequences of that performance in relation to the assignment. For another rubric example, refer to the detailed rubric in chapter 5 for developing instructional materials, including criteria and consequences.
Tables 3.3a and b. Examples of two rubrics.

The first provides little insight into expected performance, whereas the second gives clear expectations about the work and describes the consequences therein.

**Table 3.3a. Instead of:**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Excellent</th>
<th>Good</th>
<th>Poor</th>
<th>Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy of information</td>
<td>No errors were made.</td>
<td>1-3 errors were made.</td>
<td>4-6 errors were made.</td>
<td>More than 6 errors were made.</td>
</tr>
</tbody>
</table>

**Table 3.3b. Try:**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Level of performance</th>
<th>Needs improvement</th>
<th>Unacceptable</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sophisticated</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>Accuracy of information</td>
<td>No factual errors were made. Your work will be very useful in aiding the reader make a decision about whether this genetic engineering technology would be a significant contribution as an alternative method to pesticide use in agriculture.</td>
<td>No significant errors were made. The reader recognizes any errors as the result of hasty conclusions or oversights. Your work is usable for making decisions about employing this technology, but would be considered more reliable if you were more careful in proofreading your work.</td>
<td>Enough errors were made to distract the reader, but the reader is able to use the information to make judgments. The technology will appear more useful if the reader is able to decide what evidence is reliable.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Needs improvement</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Your proposed technology is highly improbable because there are so many factual errors. The reader cannot depend on this report as a source of accurate information, or you have included so little information that the reader is not sure what the technology is about. It will not be approved by the FDA.</td>
</tr>
</tbody>
</table>

The second rubric is adapted from Huba and Freed (2000).
Closing remarks

Assessment is probably the most ignored part of good teaching, so it is often the most intimidating to instructors. It need not be onerous if it is integrated into teaching in natural ways that include both large and small assessment events. Once instructors become familiar with the iterative process of assessing, teaching, and reassessing, and of teaching students to evaluate themselves, teaching without ample assessment feels like groping in the dark and it’s hard to imagine teaching without it.