Building Rubrics for Graded Lab Assignments: A Helping Hand up a Steep Slope

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Assessment of student comprehension and performance in the biology teaching laboratory is often accomplished through the use of rubrics. This exercise explores what a rubric is (and what it is not), the benefits and pitfalls of using them, and best practices for building rubrics. A universally approachable problem, the judging of chocolate chip cookies, is employed to model the rubric development process and promote discussion of issues to consider when building rubrics for lab assignments. Participants then work in small groups to develop a lab assignment rubric.

Keywords: Rubrics, grading, assessment

Introduction

Stevens and Levi (2005:3) describe rubrics as "the most effective grading devices since the invention of red ink." In practice, a rubric is more than just a tool for scoring assignments; it can also be a valuable aid in student learning. A good rubric contains specific expectations for the assignment, breaks it down into component parts based on learning objectives, and defines the qualities of an acceptable assignment. Rubrics provide many advantages to the instructor (Stevens and Levi, 2005; Suskie, 2009), including:

- faster grading
- increased consistency between and within graders
- encouraging critical thinking
- facilitating communication
- a tool to refine teaching skills and assignments

They are also beneficial to the student, as well designed rubrics can:

- increase the speed that work is returned to students
- provide detailed and relevant feedback
- encourage critical thinking
- facilitate communication
- level the playing field for students who are not as familiar with the specific type of assignment

Despite these advantages, there are instructors who believe that rubrics are not useful. They cite reasons such as:

- rubrics stifle individualism
- they require a lot of time and effort to construct
- not suitable for black and white criteria

While it is true that rubrics are not suitable, nor necessary, for items that are have only two possible outcomes (e.g., paper secured in a binder), the other two arguments often reflect a lack of understanding of how rubrics work or how to create an effective one.

The exercise included here is designed to teach the fundamentals of building a rubric using a fun example that does not have the built in biases and headaches of a more familiar assignment such as a lab report. This is followed by a procedure that helps to guide the users through the creation of a rubric for a real assignment.

First, here are a few tips to help you get started on your own rubric:

1. The first thing that you should do is define the learning goals for the assignment. This is often a difficult and overlooked part of the process, but it is helpful in making not only a useful assignment, but also to make an effective rubric. As a starting point, these learning goals become the rows in your rubric, often referred to as the Dimensions (Table 1).

2. The next step is to decide how many levels you would like in your grading scale. Though there are no set limits, from three to five levels are generally appropriate. These levels become the columns in your rubric (Table 1). After you have decided how many levels to use, the next step is to decide on how to label them. There are many different ways to this, as shown in the examples in Table 2.

Table 1. Example of rubric base structure.

	Scale Level 1	Scale Level 2	Scale Level 3	Scale Level 4
Dimension 1				
Dimension 2				
Dimension 3				
Dimension 4				

3. Make your rubric when you make your assessment. This helps to define your learning goals and to be sure that your assignment is actually meeting them. If you already have an assessment that you would like to design a rubric for, starting by defining learning goals can be helpful to determine if you are meeting those goals, or need to revise the assignment in the process.

4. Make the rubric in a group. This can be a few instructors who use the same assignment or your TAs. Not only does getting the perspectives of others make your rubric better, it helps ensure the final product makes sense to users other than yourself.

5. Try to have each box contain a single sentence. Long checklists in each box often make it difficult to assign a level to the work.

6. Test the rubric If you have old assignments, they are ideal. Designing rubrics is an iterative process and the more problems that you can work out before it is in student hands, the better.

7. Train users to grade using the rubric. It is helpful to give them a few old assignments to work through so that they can be comfortable using the rubric. The graders will likely have a variety of backgrounds and experiences with rubrics so this training is important.

8. Give the rubric to students when you assign the assessment. This provides the students with a clear description of what you expect them to do.

Once you have a rubric set up, you need to determine how you will use it to generate a score on an assessment. The first thing to decide is if the dimensions will be weighted equally or not. If you do decide to make the dimensions unequally weighted, it is important to let the students know this so they are not confused when they get their graded work back (Fig. 1).

Figure 1. An example of a rubric showing differential weighting of dimensions

Table 2. Examples of labeling schemes for scale levels.

Exemplary	Competent	Credible effort, needs work	Little or no serious effort
Exemplary	Competent	Developing	
Exemplary	Accomplished	Developing	Beginning
High Mastery	Average Mastery	Low Mastery	
Professional	Adequate	Needs work	You're fired
4	3	2	1

The next thing to worry about is weighting the scale. It can be helpful to decide what level would produce a passing score on the assignment. From here, you can go up and down as appropriate. This range does not have to be linear throughout the range. For example, scores all the way down through the three highest levels may result in score of 100%, 85% and 70%. The fourth level, reserved for barely any effort, may only be worth 30%. When using the rubric, graders should not use the average between two categories. It may be helpful to give them a rule such as: "if you aren't sure, give them the higher (or lower) score." Some rubric designers allow for a wide range of scores in each box (see Allen, 2004, p. 141 for an example). While this may work for a single grader, it is unlikely to provide the inter-grader consistency that makes rubrics so powerful. It also reduces the amount of time that is being saved by using a rubric in the first place.

Rubrics are not only effective tools for efficient grading, but they are also valuable to the students. If the same, or similar, rubric is used on numerous assignments, students can see how they are progressing on mastery of important skills and where they need to focus efforts toward continued improvement. Rubrics also provide a means for students to self-assess their work before they turn it in. Having the students create their own rubrics for an assignment is a way to teach them about the learning goals of the assignment and why you are assigning it.

Making a rubric can be a challenging if not intimidating process. The exercises presented here are designed to allow workshop participants to first construct a rubric on a familiar and fun item: chocolate chip cookies. This seemingly simple task presents the same challenges as making rubrics for grading assessments such as lab reports, but forces participants to start from fundamentals, without the distraction of preconceptions we all have about how we should judge real assignments. This is followed by the opportunity to apply this process to a real assignment, taking into consideration lessons learned from the cookie rubric exercise and encouraging a fresh look at old grading habits. Hopefully, at the end of this process, participants will have a better grasp on how to connect student assignments, learning goals, and assessment strategies in a clear and consistent framework to ultimately improve student learning outcomes.

Participant Outline

The Great Cookie Conundrum

In order to remain competitive in the rapidly expanding fast-casual restaurant sector, the *A Buon Mercato* chain is exploring the option of replacing their homemade chocolate chip cookies with a commercially available brand. They expect that some of their customers will not be happy about this, so they would like to find the best replacement cookie they can. Your task is to evaluate the five different cookies they are considering and report back to the restaurant which cookie is the best.

While it is tempting to sit down, eat a lot of cookies, and then declare which one is best, the marketing gurus would like to see some data to back up your assertions. With that in mind, you will need to devise a rubric to allow for the rating of cookies by a large number of evaluators. We will be using the Post-it model as outlined by Stevens and Levi (2005).

- On the Post-its provided, write 3 things (each on a separate sheet) that would define an excellent cookie.
- Stick them up on the board at the front of the room.
- After everyone has posted their ideas, work together to organize them into groups that represent the different characteristics that we will use to define a great cookie.
- If there are ideas that fit more than one group, you can put them in both for now.
- Set up a large sheet for each group.
- Decide on names for each group.
  ◦ The facilitator will read off the ideas in the group.
  ◦ Decide on a name.
  ◦ This should be a noun or short noun phrase.
- Write the name of the group on the top of one of the large sheets.
  ◦ This becomes one of our **Dimensions.**
- Underneath the name, write all of the different descriptions from the original Post-its on the large sheet.
  ◦ If you notice any omissions, now is a good time to add them.
- Repeat this for each of the groups.
- Divide into a number of teams equal to the number of dimensions.
- Each team should define 3 levels of quality for their dimension.
  ◦ The highest level should incorporate the characteristics listed on the big sheet.
  ◦ Use explicit and concrete terms, i.e., avoid things like good, well or poor - what does that mean?
  ◦ Avoid overlap between categories.
- After deciding on your criteria, add them to the large rubric in the front of the room.

Congratulations! You have created a rubric to evaluate cookies!

Now for the fun part: taste testing the cookies!

You should devise a method to taste the cookies in an unbiased manner. They have already been removed from their original packaging so you don't know what brand and variety you are testing. What other things should you do?

Score your cookies!

We will apply equal weighting to each dimension. To score each cookie, evaluate it and assign a score for each dimension, giving a 3 for the highest, a 2 for the middle, and a 1 for the lowest category. Total the values to determine the overall score for each cookie. This means that, if you have 5 dimensions, each cookie will have a score ranging from 5 (the worst) to 15 (the best).

Table 3. Cookie rubric.

Dimension	Cookie				
	1	2	3	4	5
Total					

Add your ratings for each cookie to the spreadsheet in the front of the room.

How much variation was there between raters?

Why might this be the case?

What would you do to perfect the rubric?

Now what?

Now that you have constructed a rubric and used it to evaluate a problem, you are ready to apply this to your classroom. The process for making a rubric for a lab report or essay is the same as what we just did for cookies. You can do it yourself or, better yet, involve other people. This can be colleagues, TAs, or even the students who will be evaluated.

The cookie exercise is based on a similar activity from Teacher Vision (2012).

Create Your Own Rubric

Get into groups based on the type of assignment for which you want to create a rubric. Choose someone in the group to be the facilitator (if nobody volunteers, try the nose game or some other grown-up method to decide who it will be). This exercise follows the same procedure that we used to evaluate the cookies. You can use these same basic steps to create a rubric by yourself, but most people find that it is easier to make effective rubrics with the input of a group of people who have knowledge of the subject.
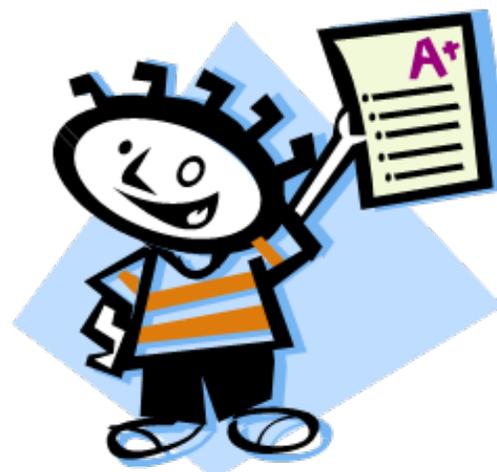
Name of Assignment: _____

1. On the Post-its provided, write 3 things (each on a separate sheet) that would define an excellent example of the assignment you are grading (you may want to write more if you have a small group).

2. Gather the Post-its and stick them up on the board (or the table or somewhere convenient where everyone can see them).

3. After everyone has posted their ideas, work together to organize them into groups that represent the different characteristics that you will use to define an ideal assignment.

    a. If there are ideas that fit more than one group, you can put them in both for now.

4. Set up a large sheet for each group.

5. Decide on names for each group.

    a. The facilitator will read off the ideas in the group.

    b. Decide on a name.

    c. This should be a noun or short noun phrase.

6. Write the name of the group on the top of one of the large sheets.

    a. This becomes one of our **Dimensions**.

7. Underneath the name, write all of the different descriptions from the original Post-its on the large sheet.

    a. If you notice any omissions, now is a good time to add them.

8. Repeat this for each of the groups.

9. Define 3-5 levels of quality for their dimension.

    a. You will need to use the same number of levels for each dimension

    b. Start with 4 if you are not sure what you want to do

    c. The highest level should incorporate the characteristics listed on the big sheet.

    d. Use explicit and concrete terms, i.e., avoid things like good, well or poor - what does that mean?

    e. Avoid overlap between categories.

10. Assign a weight to each category

    a. This is easiest to do as a % for each category

Table 4. Assignment rubric.

Dimension	Weight (%)	5	4	3	2	1

Materials

- Chocolate chip cookies
  ◦ 5 brands –enough for everyone to have at least one cookie
  ◦ Try to get a variety of textures and sizes—include one of the big cookies (e.g., Pepperidge Farm) if you can
  ◦ Large plastic bags (gallon/4 L) –to store cookies out of the original packaging
- Self-stick Easel Pad, 25 x 30.5 Inches, 30-Sheet Pad
- Self-stick notes 4" x 4"
- Large Black markers
- Index cards with random sequence of 1-5 on them
- Cups and water
- Large dry erase/chalkboard in room

Notes for the Instructor

Methodology Instructions

The rubric that is created in the cookie exercise is rarely perfect, as is typical of rubrics in general. We have found that the cookies provide many of the same problems that show up in real assignments. These include:

- The ideal is in the middle – how should you handle too little and too much?
- The predefined levels are not applicable when you start to look at real assignments
- The halo effect – this occurs when you have multiple dimensions measuring the same thing – e.g., if you score the use of citations in the Introduction and then again in their own category (Allen, 2004).
- Is the criterion actually gradable?
- Is there enough variation among the assignments to make the criterion informative?

Building rubrics is an iterative process. It is helpful to discuss what you would change for a revised rubric. Ideally, this workshop should engender active discussion of these issues among participants.

Some individuals may not be able to participate in the tasting of the cookies due to allergies or other dietary restrictions. We have found that they still gained a lot out of the workshop. It would be simple to change the product in the cookie exercise to something that is universal for the group you are working with.

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