

“Provides practical and proven tools for assessing and improving learning and performance in science. You and your students will unquestionably benefit from their use.”

—Jay McTighe

RUBRICS

for Assessing Student Achievement
in **SCIENCE GRADES K-12**



HAYS B. LANTZ, Jr.

Foreword by Jay McTighe

Writing to Persuade in Science (Analytic Rubric)

Name _____ Date _____ Course/Class _____

Task/Assignment _____

	Development	Organization	Audience	Language
Expert 4	<u>Development:</u> The writer identifies a clear position and fully supports or refutes that position with relevant, accurate scientific and/or personal information. <input type="checkbox"/>	<u>Organization:</u> The writer presents an organizational plan that is logical and consistently maintained. <input type="checkbox"/>	<u>Audience:</u> The writer effectively addresses the needs and characteristics of the identified audience. <input type="checkbox"/>	<u>Language:</u> The writer consistently uses relevant, scientific vocabulary and language choices to enhance the text. <input type="checkbox"/>
Proficient 3	<u>Development:</u> The writer identifies a clear position and partially supports or refutes that position with relevant, accurate scientific and/or personal information. <input type="checkbox"/>	<u>Organization:</u> The writer presents an organizational plan that is logical and maintained, but with minor flaws. <input type="checkbox"/>	<u>Audience:</u> The writer adequately addresses the needs and characteristics of the identified audience. <input type="checkbox"/>	<u>Language:</u> The writer frequently uses relevant, scientific vocabulary and language choices to enhance the text. <input type="checkbox"/>
Emergent 2	<u>Development:</u> The writer identifies a position, yet that position lacks clarity. The writer tries to support or refute that position with relevant, accurate scientific and/or personal information. <input type="checkbox"/>	<u>Organization:</u> The writer presents an organizational plan that is only generally maintained. <input type="checkbox"/>	<u>Audience:</u> The writer minimally addresses the needs and characteristics of the identified audience. <input type="checkbox"/>	<u>Language:</u> The writer sometimes uses scientific vocabulary and language choices to enhance the text. <input type="checkbox"/>
Novice 1	<u>Development:</u> The writer identifies an ambiguous position with little or no relevant, accurate scientific and/or personal information to support that position; or the writer fails to identify a position. <input type="checkbox"/>	<u>Organization:</u> The writer presents an argument that is illogical and/or minimally maintained. <input type="checkbox"/>	<u>Audience:</u> The writer does not address the needs and characteristics of the identified audience. <input type="checkbox"/>	<u>Language:</u> The writer seldom, if ever, uses scientific vocabulary and language choices to enhance the text. <input type="checkbox"/>

Figure 1.6 An Example of an Analytic Rubric for Writing to Persuade for Grades 7–12

Using Student Sample 1 from the first chapter (shown below) and applying the holistic rubric for Scientific Drawing, the student would have received a novice (1) rating. The characteristics of the drawing closely parallel that of the novice level in that no title is included, no description of what the drawing depicts is included, no measurements are stated, and the labeling of the parts of the pendulum is not consistently neat and legible.

Now, let's turn our attention to another type of rubric, known as the analytic rubric. How is it distinguished from the holistic rubric?

CHARACTERISTICS OF ANALYTIC RUBRICS

- Describe the different dimensions of the performance
- Provide separate ratings for each of the different dimensions of the performance (can be generalized or task specific)
- Provide multiple scores on the performance

Table 3.2 shows the strengths and weaknesses of analytic rubrics.

An example of an analytic rubric constructed from the traits of the holistic rubric of Scientific Drawing is shown in Figure 3.2. The small boxes within each cell are used for self-assessment, peer assessment, and/or teacher assessment. Using Sample 1 again and applying the analytic rubric, the student would have received the following ratings:

- Emergent (2) for Accuracy and Realism
- Novice (1) for Scale and Proportion
- Emergent (2) for Labeling
- Novice (1) for Titles and Accompanying Text

As can be evidenced from scoring the same sample with both holistic and analytic rubrics, somewhat different scores can emerge. This is a reflection of the design of the two different tools. The holistic tool, although quicker to use, does not provide the diagnostic details to let students know why they received a "1" instead of a "2." However, if the teacher adds comments or designates goals or actions to be taken by the student, then this shortcoming of the holistic tool can be somewhat ameliorated.

Chapter 4 contains actual examples of performance list rubrics, holistic rubrics, and analytic rubrics for many performances that are common in performance-based science classes. They have been field-tested and revised for several years with students in Grades K-12.

Table 3.2 Advantages and Disadvantages of Analytic Rubrics

Advantages	Disadvantages
<ul style="list-style-type: none"> • Provides useful feedback about the strengths and weaknesses of each student's performance and of the instruction (more diagnostic) 	<ul style="list-style-type: none"> • Can be time-consuming to construct and use • Can make it hard to see the forest for the trees
<ul style="list-style-type: none"> • Provides detailed basis for judging performances 	
<ul style="list-style-type: none"> • Provides extra details when multiple scorers are scoring the same piece of work 	
<ul style="list-style-type: none"> • Provides extra details for multiple grade levels to emphasize the same criteria 	

Scientific Drawing (Analytic Rubric)

Name _____

Date _____

Course/Class _____

Task/Assignment _____

	Accuracy and Realism	Scale and Proportion	Labeling	Titles and Accompanying Text
Expert (4)	The drawing(s) realistically and effectively depict(s) the object(s). Amazing detail is provided for size, color, texture, and shape. Multiple perspectives are provided to clearly distinguish form, structures, and dimensions. The scientific content is accurately represented and is appropriate for the drawing. <input type="checkbox"/>	A very precise scale and proportion is provided using metric measurements. The scale and proportion are appropriate for showing details. The scale is stated either in the drawing itself or the accompanying key or legend. The relationship between the object and its environment is shown. <input type="checkbox"/>	All distinguishing forms, structures, and details are clearly labeled. Labeling is consistently neat, legible, and attractive in appearance. <input type="checkbox"/>	A descriptive and accurate title of the drawing(s) is provided. A detailed, interpretative, written explanation of what the drawing(s) is/are intended to show is provided. <input type="checkbox"/>
Proficient (3)	The drawing(s) depict(s) the object(s). Amazing detail is provided for size, color, texture, and shape. Multiple perspectives are missing. The scientific content is accurately represented and is appropriate for the drawing. <input type="checkbox"/>	A very precise scale and proportion is provided using metric measurements. The scale and proportion are appropriate for showing details. The legend or key of the scale is missing. The relationship between the object and its environment is shown. <input type="checkbox"/>	All distinguishing forms, structures, and details are clearly labeled. Labeling is not consistently neat, legible, and attractive in appearance. <input type="checkbox"/>	A title of the drawing(s) is provided. A written explanation of what the drawing(s) is/are intended to show is provided. However, in both cases, details and clarity are lacking. <input type="checkbox"/>

Figure 3.2 Analytic Rubric for Scientific Drawing

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(Continued)

Concept Map

Name _____ Date _____ Course/Class _____

Task/Assignment _____

Performance Criteria	Assessment			
	Points	Self	Teacher	Other(s)
1. The most general concept is at the top of the map.				
2. I included appropriate linking words to connect the concepts.				
3. The linking words used to connect concept words make the connection between the two concept words understandable.				
4. My concept map has an appropriate title that tells what the specific main idea is on the map.				
5. My concept map is easy to follow.				

Comments	Goals	Actions
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Figure 6.2 Concept Map

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Cooperative Learning

Name _____ Date _____ Course/Class _____

Task/Assignment _____

Performance Criteria	Assessment			
	Points	Self	Teacher	Other(s)
1. I did my job.				
2. I got along with others in my group.				
3. My group received at least one compliment or praise.				
4. I listened to others and their ideas.				
5. My group finished all that was expected.				
6. I did better in the group than if I had worked alone.				

Comments	Goals	Actions

Figure 6.3 Cooperative Learning

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Designing a Scientific Experiment

Name _____ Date _____ Course/Class _____

Task/Assignment _____

Performance Criteria	Assessment			
	Points	Self	Teacher	Other(s)
1. There is a testable question for the experiment.				
2. Research (literature review) was done to learn more about the question.				
3. The design of the experiment tests the hypothesis.				
4. A list of all necessary materials is included.				
5. A detailed step-by-step procedure is included.				
6. The procedures are written clearly enough so that another person could repeat the experiment.				
7. The procedure shows that repeated trials were done.				
8. Data were collected and recorded for each trial.				
9. An appropriate graph was created to display the data.				
10. Conclusions were drawn using the data.				
11. The conclusions refer back to the hypothesis.				
12. Ideas for future research are included.				
13. A log or journal was used to record observations.				
14. A three- or more sentence summary was written explaining and describing what was discovered or learned.				

Comments	Goals	Actions

Figure 6.6 Designing a Scientific Experiment

Hypothesizing

Name _____ Date _____ Course/Class _____

Task/Assignment _____

Performance Criteria	Assessment			
	Points	Self	Teacher	Other(s)
1. My hypothesis is directly related to the question.				
2. My hypothesis is a simple statement that is based on research and/or what I already know about the question.				
3. My hypothesis states what I believe will happen and why.				
4. My hypothesis is a clear declarative statement.				
5. My hypothesis is written as a complete sentence beginning with a capital letter and ending with a period.				

Comments	Goals	Actions

Figure 6.8 Hypothesizing

Observing and Drawing Conclusions

Name _____ Date _____ Course/Class _____

Task/Assignment _____

Performance Criteria

1. All appropriate senses (**except** taste) were used to make observations.
2. Appropriate scientific tools and materials were used to make the observations.
3. Correct metric measurements were taken when necessary.
4. Both the quantity and the unit for each measurement were recorded.
5. Observations were based on what was actually observed and not inferred.
6. Collected data were recorded and organized clearly and accurately.
7. Reasonable conclusions were drawn using observations, collected data, and what was already known.

Assessment			
Points	Self	Teacher	Other(s)

Comments	Goals	Actions
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Figure 6.9 Observing and Drawing Conclusions

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