Scoring Guidelines For Problems of the Month

Rubrics

The criteria for scoring problems or tasks are called "rubrics." The rubrics are designed for use in a professional collaborative setting: teachers scoring together around a table, with discussion. This type of scoring has proved to be a powerful tool when used by teachers and students in self-assessment. The rubrics are designed to be easily adaptable to classrooms.

The Problem of the Month rubrics focus on the performance rather than on the performer. Scorers are directed by the rubric to the evidence in the response. To help make distinctions, scorers are asked to consider what feedback to the student would be appropriate based on the evidence in the response. The formulation of scoring decisions based, in part, on the feedback idea, has proven helpful to teachers and scorers who seek reliable scores based on sound classroom practice.

A rubric is based on the core elements of performance of the problem or task. The core elements of performance include both the essential mathematics assessed and the process at which the students solve and communicate their results. The core elements of performance are stated in the rubric.

Generic Holistic Rubric

5: Accomplishes the Task with Distinction
The response completely accomplishes the core performance of the task and goes beyond the task requirements. A distinguished performance is exciting – a gem. It excels and merits nomination for distinction by meeting the standards for a "4" and demonstrating special insights or powerful generalizations or eloquence or other exceptional qualities.

4: Accomplishes the Task
The response accomplishes the prompted purpose. The student's strategy and execution are at a level consistent with the core elements of performance including math standards and qualitative demands of the task. Communication is judged by its effectiveness, not by grammatical correctness or length. Although a "4" need not be perfect, any defects must be minor and very likely to be repaired by the student's own editing, without benefit of a note from a reader.

3: Ready for Revision
Evidence in the response convinces you that the student can revise the work to a "4" with help of written feedback. The student does not need a dialog or additional teaching. Any overlooked issues, misleading assumptions, or errors in execution – to be addressed in the revision – do not subvert the scorer's confidence that the student's mathematical power is ample to accomplish the task.

2: Partial Success with More Instruction Needed
Part of the core elements of performance is accomplished, but there is a lack of evidence - or evidence of lack – in some areas needed to accomplish the whole task. It is not clear that the student is ready to revise the work without a conversation or more teaching.

1: Engaged Task with Little Success
The response may have fragments of appropriate material from the core elements of performance and may show effort to accomplish the task, but with little or no success. The task may be misconceived, or the approach may be incoherent, or the response might lack any correct results. Nonetheless, it is evident that the respondent tackled the task and put some math knowledge and tools to work.

0: No Response or Off Task
There is no evidence that the task was engaged. The response is blank or there are marks, words or drawings unrelated to the task.

Cutting the Cube

Task Description

The problem asks the student to examine a cube to analyze the attribute of a cube and how a cube can be cut into a flat pattern, as well as what flat patterns can be made into cubes.

Characteristics of Performance

The Core Elements of the Performance are:

- recognizes and identifies the attributes of a cube. (A)
- determines the least number of cuts it takes to divide a cube into a single flat pattern or net. (B)
- explains why it takes 7 cuts to make a cube a net (B)
- explains that any arbitrary 7 cuts do not determine a unique net. (C)
- shows multiple examples of nets that can be folded into a cube. (C)
- determines all the unique nets that fold into a cube. (D)
- explains a valid process for determining all the unique nets that fold into a cube. (D)
- draws all unique hexominoes. (E)
- explains a valid process for determining all the unique hexominoes. (E)

Circumstances of Performance

The problem of the month is designed as an individual task with opportunities to consult with other classmates and receive supportive questioning from others.

The problem was intended to take approximately 5 to 7 days. Some primary students will use up to an entire math period to complete level A and then be assisted with translating their verbal "write-up". Other students may take longer than 7 days, especially if they are attempting an extension to the problem or doing revisions for a published product. Give students ample time.

The task is designed with the assumption that each student has access to various materials including calculators, rulers, and manipulatives. This is an "open book" assessment. While students work, be supportive and encourage them with good questions, be careful not to lead them with any particular approach. Remind students that they may use their tools, calculator and ruler. Encourage them to write what makes sense to them and to persist until it makes sense.

Cutting a Cube
Holistic Scoring Rubric

4: Accomplishes the Core Elements of Performance
The response achieves the core elements of the problem.
- recognizes and identifies the attributes of a cube. (A)
- determines the least number of cuts it takes to divide a cube into a single flat pattern or net. (B)
- explains why it takes 7 cuts to make a cube into a net (B or C)
- explains why any arbitrary 7 cuts do not determine a unique net. (C)
- shows multiple examples of nets that can be folded into a cube. (C)
- determines all the unique nets that fold into a cube. (D)
- explains a valid process for determining all the unique nets that fold into a cube. (D)
- draws all unique hexominoes. (E)
- explains a valid process for determining all the unique hexominoes. (E)

For Level A, the student should identify the attributes of a cube; 12 edges, 8 vertices and 6 faces. The student explains a way they remember or know the attributes and how they figured it out.

For level B, the student determines that it takes exactly 7 cuts to transform a cube into a net (flat pattern of 6 square connected into a single piece). The student explains that it always take 7 cuts no matter what net is made. The student explains the process they used to determine their answer.

For level C, the student illustrates multiple nets that can be refolded into a cube. The student explains how to cut the cube to create the different nets. The student explains that it takes 5 edges to keep the 6 faces connected and there are 12 edges in all, so the difference of 7 edges is what needs to be cut to make a cube. The student explains that cutting any 7 arbitrary edges may not result in a net, because an entire square could be severed.

For level D, the student illustrates all 11 unique nets that can be folded into a cube. The student explains a process of determining the 11 unique nets. Some methods include creating a systematic process of finding the nets or building on the pentominoes that fold into an open box or classifying the nets into specific sets. The student uses their method to explain why they have found all possible nets that fold into a box.

For level E, the student illustrates all 35 unique hexominoes. The student explains a process of determining all 35 unique hexominoes. Some methods include creating a systematic process of finding the hexaminoes or building on the each of the possible pentominoes or classifying the hexominoes into specific sets. The student uses their method to explain why they have found all possible hexominoes.

3: Ready for Revision
The student demonstrates understanding and skills to meet the core elements of performance with some errors or omissions. Any overlooked issues, misleading assumptions or errors in execution – to be addressed in the revision – do not subvert the scorer's confidence that the student has learned the relevant mathematics to accomplish the task. Some of the explanations may be limited and minor error may occur, put there is evidence that the core elements of performance are met.

2: More Instruction Needed
Part of the response is successful, but there is a lack of evidence – or evidence of lack -- in some areas needed to accomplish the whole task. Part of the task is accomplished, but the student is not ready to revise the work without a conversation or more teaching. Given a problem level, the student's work is unsuccessful or incomplete.

1: Engaged Task with Little Success
The response may have fragments of appropriate material from the core elements of performance and may show effort to accomplish the task, but with little or no success. Given a problem level, the student demonstrates minimal understanding of the task and/or little success.