Designing Standards Based Assessments

Matt Roscoe

The University of Montana
1. Developing Common Assessments: Prerequisites
2. Sorting Assessments Activity
3. Design Element 1: A Common Scale
4. Design Element 2: Adapt Scale to Learning Target
5. Design Element 3: Build Assessment
6. Building a Common Assessment Activity
Kanold’s (2012) Seven Stages of Teacher Collaboration

Stage 1: Filling the time
Stage 2: Sharing Personal Practice
Stage 3: Planning
Stage 4: Developing common assessments
Stage 5: Analyze student learning
Stage 6: Adapting instruction to student needs
Stage 7: Reflecting on instruction
A willingness by teachers to de-privatize their practice is a fundamental prerequisite to the development of common assessments.
Why should you be willing to de-privatize your practice and participate in a common assessment effort?

- You will learn about your students’ knowledge base
- You will enrich your own knowledge base for teaching
- Educational challenges will be overcome through collaborative effort
- You will acquire new skills in the design, collection, analysis and interpretation of educational measures
Developing Common Assessments: Prerequisites

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Common Assessment Effort Example: Harel’s (1994) Orange Juice Problem
The task posed to the children is in Figure 1. It presents a drawing of a carton of orange juice, called California Orange Juice, with a label describing the amounts of its ingredients: "40 oz. of water and 24 oz. of orange concentrate." Below this, there is a drawing of two glasses with corresponding labels: "7-oz. glass of California Orange Juice" and "4-oz. glass of California Orange Juice." The regions of the glasses are shaded in, indicating that the glasses are filled up to the top. In the end, the child is asked: (a) Would the orange juice from the 7-oz. glass taste the same as the orange juice from the 4-oz. glass? (b) If they wouldn't taste the same, can you tell which one would taste more orangy? (c) Explain.

Would the 7-oz. glass taste the same as the 4-oz. glass? If they don’t taste the same, can you tell which one would taste more orangy?

Answer: __________________________________________

Explain: __________________________________________
## Developing Common Assessments: Prerequisites

### Common Assessment Results - Counts

<table>
<thead>
<tr>
<th>Grade</th>
<th>4oz</th>
<th>7oz</th>
<th>Equal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th</td>
<td>10</td>
<td>10</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>6th</td>
<td>7</td>
<td>5</td>
<td>27</td>
<td>39</td>
</tr>
<tr>
<td>7th</td>
<td>39</td>
<td>38</td>
<td>113</td>
<td>190</td>
</tr>
<tr>
<td>8th</td>
<td>35</td>
<td>29</td>
<td>92</td>
<td>156</td>
</tr>
<tr>
<td>All</td>
<td>91</td>
<td>82</td>
<td>242</td>
<td>415</td>
</tr>
</tbody>
</table>
### Common Assessment Results - Row Percentages

<table>
<thead>
<tr>
<th>Grade</th>
<th>4oz</th>
<th>7oz</th>
<th>Equal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>5th</td>
<td>36</td>
<td>36</td>
<td>29</td>
<td>100</td>
</tr>
<tr>
<td>6th</td>
<td>18</td>
<td>13</td>
<td>69</td>
<td>100</td>
</tr>
<tr>
<td>7th</td>
<td>21</td>
<td>20</td>
<td>59</td>
<td>100</td>
</tr>
<tr>
<td>8th</td>
<td>22</td>
<td>19</td>
<td>59</td>
<td>100</td>
</tr>
<tr>
<td>All</td>
<td>22</td>
<td>20</td>
<td>58</td>
<td>100</td>
</tr>
</tbody>
</table>
Establishing Norms of Behavior

- Confidentiality
- Non-judgement
- Equity of Voice
- Focus on Results
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8 Pieces of Student Work

- Learning Targets: 4-7 Mathematics
- Variety of Types of Assessment
- Side 1 - Assessment Instrument
- Side 2 - Student Work
Task Description: Sort Assessments

- Form 3 groups of 2 at each table
- Group 1: Sort assessments according to “nature” of the assessment technique
- Group 2: Sort assessments according to depth of student knowledge measured
- Group 3: Sort assessments according to ease of implementation
- Complete the task in 5 minutes
Task Description: Share Results

Within-Group Jigsaw Protocol: Each member of a team/group works independently to master a portion of a topic or skill. When each team member has completed the work as planned, they gather at an agreed upon time to share the new knowledge. Often there is some kind of synthesis of the shared knowledge.

National School Reform Faculty Protocols:
http://www.nsrfharmONY.org/free-resources/protocols/a-z
A defining characteristic of the process of formative assessment is that it uses formative scores to track student progress over time leading to an estimate of a summative score...what scale should be used for designing formative assessments?
Research has shown that educators should be skeptical of the reliability of the 100-point scale. (Marzano, 2002; Bailey and Guskey, 2001; Haponstall, 2009)
Design Element 1: A Common Scale

An Illustration: A Theoretical Assessment (Marzano, 2010)

Section A: Ten multiple choice items that are factual in nature but important to the topic

Section B: Four short constructed-response items that require students to explain principles or give examples of generalizations as presented in class

Section C: Two short constructed-response items that require students to make inferences and applications that go beyond what was presented in class
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Points Possible</th>
<th>Student Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Ten multiple choice items that are factual in nature but important to the topic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Four short constructed response items that require students to explain principles or give examples of generalizations as presented in class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Two short constructed response items that require students to make inferences and applications that go beyond what was presented in class</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>
### Design Element 1: A Common Scale

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Points Assigned Section A</th>
<th>Points Assigned Section B</th>
<th>Points Assigned Section C</th>
<th>Student Final Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher 1</td>
<td>40</td>
<td>40</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Teacher 2</td>
<td>20</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Teacher 3</td>
<td>60</td>
<td>20</td>
<td>20</td>
<td>70</td>
</tr>
<tr>
<td>Teacher 4</td>
<td>70</td>
<td>20</td>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>Teacher 5</td>
<td>20</td>
<td>20</td>
<td>60</td>
<td>30</td>
</tr>
</tbody>
</table>
Design Element 1: A Common Scale

The capriciousness of “weighting” the 100-point scale identifies a need for a new scale that matches the learning progression that leads to the acquisition of a targeted learning goal.
## Design Element 1: A Common Scale

### The 4-Point Scale: Generic

<table>
<thead>
<tr>
<th>Score</th>
<th>Content</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>More complex content</td>
<td>Beyond Proficient</td>
</tr>
<tr>
<td>3</td>
<td>Target learning goal</td>
<td>Proficient</td>
</tr>
<tr>
<td>2</td>
<td>Simpler content</td>
<td>Nearing Proficient</td>
</tr>
<tr>
<td>1</td>
<td>With help, partial success</td>
<td>Novice</td>
</tr>
<tr>
<td>0</td>
<td>Even with help, no success</td>
<td>Beginner</td>
</tr>
</tbody>
</table>
The 4-Point Scale: Full Descriptions

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>In addition to exhibiting level 3 performance, the student’s responses demonstrate in-depth inferences and applications that go beyond what was taught in class</td>
</tr>
<tr>
<td>3</td>
<td>The student’s responses demonstrate no major errors or omissions regarding any of the information and/or processes</td>
</tr>
<tr>
<td>2</td>
<td>The student’s responses indicate major errors or omissions regarding the more complex ideas and processes; however they do not indicate major errors or omissions relative to the simpler details and processes</td>
</tr>
<tr>
<td>1</td>
<td>The student provides responses that indicate a distinct lack of understanding of the knowledge. However, with help, the student demonstrates partial understanding of some of the knowledge</td>
</tr>
<tr>
<td>0</td>
<td>The student provides little or no response. Even with help the student does not exhibit a partial understanding of the knowledge</td>
</tr>
</tbody>
</table>
The generic 4-point scale should be “adapted to fit” a learning target prior to the creation of a common assessment tool.
A Learning Target

Fluently multiply multi-digit whole numbers using the standard algorithm. (Montana Common Core 5.NBT.B.5)
### The 4-Point Scale: Multi-Digit Multiplication (MCC 5.NBT.B.5)

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Student can fluently multiply 2- and 3-digit whole numbers using the standard algorithm, in addition, the student can estimate the product, diagnose errors in the use of the algorithm and use multi-digit multiplication to solve story problems</td>
</tr>
<tr>
<td>3</td>
<td>Student can fluently multiply 2- and 3-digit whole numbers using the standard algorithm</td>
</tr>
<tr>
<td>2</td>
<td>The student can recall whole number multiplication facts (1-12) and can multiply 1-digit by a 2-digit whole numbers greater than 12, but can only successfully multiply 2-digit by 2-digit whole numbers using the standard algorithm with additional guidance</td>
</tr>
<tr>
<td>1</td>
<td>The student can recall whole number multiplication facts (1-12) but can only successfully multiply 1-digit by a 2-digit whole numbers greater than 12, using the standard algorithm with additional guidance</td>
</tr>
<tr>
<td>0</td>
<td>The student has difficulty recalling whole number multiplication facts (1-12) and cannot successfully multiply multi-digit whole numbers using the standard algorithm with additional guidance</td>
</tr>
</tbody>
</table>
When using a 4-point scale, a minimum of 3 “differentiating” sections are called for...

<table>
<thead>
<tr>
<th>Section</th>
<th>Content</th>
<th>Differentiates</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.0 Content</td>
<td>Level 1 / Level 2</td>
</tr>
<tr>
<td>B</td>
<td>3.0 Content</td>
<td>Level 2 / Level 3</td>
</tr>
<tr>
<td>C</td>
<td>4.0 Content</td>
<td>Level 3 / Level 4</td>
</tr>
</tbody>
</table>
Marzano (2010) suggests...

<table>
<thead>
<tr>
<th>Section</th>
<th>Content</th>
<th>Question Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.0</td>
<td>Selected Response</td>
</tr>
<tr>
<td>B</td>
<td>3.0</td>
<td>Short Constructed Response</td>
</tr>
<tr>
<td>C</td>
<td>4.0</td>
<td>Short Constructed Response</td>
</tr>
</tbody>
</table>
Table 3.8 Sample Test

Section A

1. True or False: All diseases are inherited.

2. True or False: If your mom is afraid of roller coasters, you will inherit that fear from her.

3. Examples of inherited traits are ___________ and ___________.

4. Put a check in front of the traits you can develop over time.
   - [ ] Shoe size
   - [ ] Gender
   - [ ] Knowledge of history
   - [ ] Fear of snakes

Section B

5. Name three traits you like about yourself. Are these heritable traits or not? Explain your answer.

   ____________________________________________________________

   ____________________________________________________________

   ____________________________________________________________

6. Joey signed up for the summer spelling bee just after Christmas. He did not practice very much because he was playing baseball, and he went to Florida with his parents over spring break. When the bee came, he lost in the first round. Later that night, he told his mother he lost because he is not very smart about words. Do you think this is correct? Why or why not?

   ____________________________________________________________

   ____________________________________________________________

7. Simon's mother always asks him to go to the grocery store with her so that he can reach the items on the top shelf. He can reach almost everything she points out. Is this because Simon was born tall, or is it because he has so much practice reaching for items in high places? Has he inherited his ability to reach items on the top shelf? Explain your answer.

   ____________________________________________________________

   ____________________________________________________________

Section C

8. Hemophilia is an inherited disease that prevents your blood from clotting. This means that if you ever get a cut or a scrape, you might lose so much blood that it could be life threatening. If you were born with this disease, what kinds of things would you have to avoid? What kinds of things might you be good at instead? What kinds of personality traits might you have that other people might not have? Explain your answer.

   ____________________________________________________________

   ____________________________________________________________

   ____________________________________________________________
Design Element 3: Build Assessment

Roscoe adaptation...

<table>
<thead>
<tr>
<th>Section</th>
<th>Content</th>
<th>Question Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2.0 Content</td>
<td>10 True False</td>
</tr>
<tr>
<td>II</td>
<td>3.0 Content</td>
<td>4 Constructed Response: Short</td>
</tr>
<tr>
<td>III</td>
<td>4.0 Content</td>
<td>4 Constructed Response: Long</td>
</tr>
</tbody>
</table>
MATH 136 Exam 3

I. Circle TRUE or FALSE. Correct each false statement for 1pt of extra credit.

1. (2pts) If $\overline{A'B'}$ is the result of an isometric transformation of $\overline{AB}$, then, $\overline{AB} = \overline{A'B'}$.  TRUE FALSE

2. (2pts) Translation is a transformation of the plane that moves every point in the plane a specified distance in a specified direction.  TRUE FALSE

3. (2pts) On the coordinate plane, the transformation $(x, y) \rightarrow (y, x)$ is a rotation of 90 degrees about the origin.  TRUE FALSE

4. (2pts) On the coordinate plane, if one non-vertical line is perpendicular to another non-vertical line, then the product of the slopes of the two lines is one.  TRUE FALSE

5. (2pts) Reflection is a transformation of the plane that fixes every point on the line of reflection and sends every point $P$ not on the line of reflection to a point $P'$ such that the $PP'$ is perpendicularly bisected by the line of reflection.  TRUE FALSE

6. (2pts) Translation is the only isometric transformation of the plane in which a segment and the segment’s image are always parallel.  TRUE FALSE

7. (2pts) If one polygon is the dilated image of another polygon, then the two polygons are always congruent.  TRUE FALSE

8. (2pts) If a segment is dilated with scale factor $r > 0$, then its image is always a segment that is parallel to the pre-image and $r$ times as long as the pre-image.  TRUE FALSE

9. (2pts) Two figures are always congruent if one is the image of the other by a sequence of isometric transformations followed by a dilation.  TRUE FALSE

10. (2pts) Any rectangle can be used to develop an example of a regular tessellation of the plane.  TRUE FALSE
II. Provide answers in the spaces provided.

11. (8pts) Find the image of $\triangle ABC$ under the following transformations:

(a) A rotation about the origin by 180°

(b) $(x, y) \rightarrow (x + 3, y - 5)$

12. (8pts) Find the image of $\triangle ABC$ under the following transformations:

(a) A reflection in the $y$-axis

(b) A reflection in the line $y = x$

13. (8pts) The following figure shows a dilation of $\triangle ABC$. Find the center of dilation and the scale factor of the dilation.

14. Indicate which of the following figures will always tessellate the plane.

a) (2pts) Isosceles Trapezoid    Tessellates    Does Not Tessellate

b) (2pts) Circle                Tessellates    Does Not Tessellate

c) (2pts) Rhombus               Tessellates    Does Not Tessellate

d) (2pts) Regular Hexagon       Tessellates    Does Not Tessellate
III. Show all your work. Provide Justification. Clearly explain your reasoning.

15. (8pts) Describe a sequence of isometries to demonstrate that the two triangles are congruent.

16. (8pts) The preimage and image resulting from a single isometric transformation are shown below. Identify the transformation. Identify all the hidden elements associated with the transformation and name them appropriately.

17. (8pts) Show how to represent the letter ‘T’ drawn below in perspective using the indicated vanishing point and a scale factor of $\frac{1}{2}$. Identify which mathematical transformation enables artwork to gain perspective.

18. (8pts) Prove that a regular pentagon cannot be used to create a regular tessellation of the plane.
Building a Common Assessment Activity

Task Description: Build a Mini-Assessment in Mathematics

Target: Fluently multiply multi-digit whole numbers using the standard algorithm. (Montana Common Core 5.NBT.B.5)

- Form 3 groups of 2 at each table
- Group 1: Write level 2 assessment item(s)
- Group 2: Write level 3 assessment item(s)
- Group 3: Write level 4 assessment item(s)
- Whole Group: Compile Assessments on Poster Paper for a Gallery Viewing