On Formative Assessment

With Student Journals

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May 15, 2001
Overview

- Framework for formative (and summative) assessment
- Formative assessment with Journals
- Framework
- Study findings
- Reprise: Journals and formative assessment—practical advice
Formative & Summative Assessment: Degree of Instructional Sensitivity

Depth of Assessment Probe

Remote: Standardized National Science Achievement Tests

Distal: Large-Scale Performance Assessment from State/National Curriculum Framework

Proximal: Same Concept/Principle--New Investigation

Close: “Embedded” Assessments -- A Slightly More Advanced Activity in Unit

Immediate: Lab Notebooks & Classroom Tests

Classroom Instruction
Focus on Formative Assessment

- **Type**
  - Formative
  - Summative

- **Purpose**
  - Learning
  - Certification
  - Accountability

- **Agency**
  - student
  - teacher
  - external tests
  - individual
  - sample surveys

Match   Mismatch

Paul Black 3/98
Formative (Classroom) Assessment

• *Everyday teaching practice conceived as integral in assessment*

• Assessment used to determine *gap* between what a student knows and knowledge goal

• Teacher, *peer*, and *self* assessments comprise classroom assessment

• Feedback critical to close the gap
  – Grades?
  – Qualitative feedback useful to closing gap?
  – Both?
Classroom Assessment: Examples

- Teacher
  - Observations
  - Questions
  - Interviews
  - Journals
  - Curriculum-provided and/or teacher assessments
  - Self and Peer (Clear goals absolutely essential)
    - Review/grade each other’s work
    - Review each other’s journals
    - Reflect on learning
The Assessment Triangle

Learning/Achievement (cognition)

Assessment

Interpretation

Pellegrino, Chudowsky, & Glaser, in press
Classroom Assessment: Journals

Science Journal

Milkshakes are a solution with

Mixtures and solutions are solutions

Separating mixtures

<table>
<thead>
<tr>
<th>Color</th>
<th>Texture</th>
<th>Particle shape</th>
<th>Particle size</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>Smooth</td>
<td>Round</td>
<td>Small</td>
<td>Water</td>
</tr>
<tr>
<td>Red</td>
<td>Grainy</td>
<td>Square</td>
<td>Large</td>
<td>Sugar</td>
</tr>
</tbody>
</table>
Journals: An Assessment Tool for Teachers and Students

*Journals:*

- Are a written account of what students do in their science class, and possibly, of what they learn.
- May provide an *unobtrusive* indicator of class experiences.
- Are seen as an *immediate* assessment -- in very close proximity to the curriculum.
- Are viewed as assessments at two levels:
  - at the *individual level* are considered a source of evidence bearing on student’s performance over a course of instruction.
  - at the *classroom level* are a source of evidence of opportunities students had to learn science.
The Assessment Triangle: Science Journals

**Learning/Achievement**

- Student performance
  - Scientific communication
  - Conceptual understanding
  - Procedural understanding
- Opportunities to learn
  - Instructional implementation
  - Quality of teacher feedback

**Journals as Assessment Tools:**

- At the individual level and at the aggregated classroom level.
- An immediate/unobtrusive assessment
The Assessment Triangle: Science Journals

Learning/Achievement

Journals as Assessment Tools

Interpretation

- Can science journals provide trustworthy and valid evidence on student performance?
- What do journals tell us about student performance?
- What do journals tell us about opportunity to learn?
A science journal is a compilation of entries that provides a partial record of the instructional experiences a student had in her classroom during a certain period of time.
Method

• Sample
  – 10 fifth grade classrooms
  – A random stratified sample from each class: 2 low, 2 middle, and 2 high

• Curriculum: Full Option Science System (FOSS)
  – Variables unit in fall
  – Mixtures unit in spring
Method

• Coding each entry into different scores:
  – Instructional implementation
  – Type of entry
  – Student performance
  – Teacher feedback

• Procedures
  – Pre-posttest design using performance assessments
  – 28 Variables and 22 Mixtures journals were coded by two coders.
Technical Characteristics of Journal Scores

**Reliability**

<table>
<thead>
<tr>
<th>Type of entry</th>
<th>% of Agreement</th>
<th>Intercoder Reliability</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Student performance</td>
</tr>
<tr>
<td>Variables</td>
<td>85</td>
<td>.85</td>
</tr>
<tr>
<td>Mixtures</td>
<td>85</td>
<td>.84</td>
</tr>
</tbody>
</table>

**Validity**

Students’ journal scores were correlated with their performance assessment scores (on average $r = .52$).
Student Performance

<table>
<thead>
<tr>
<th>Score</th>
<th>Scientific communication</th>
<th>Conceptual understanding</th>
<th>Procedural understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0</td>
<td>Variables in the fall</td>
<td>Mixtures in the spring</td>
<td>Variables in the fall</td>
</tr>
<tr>
<td>2.5</td>
<td>Variables in the fall</td>
<td>Mixtures in the spring</td>
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<td>2.0</td>
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<td>Mixtures in the spring</td>
<td></td>
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<tr>
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<td></td>
</tr>
<tr>
<td>0.5</td>
<td>Variables in the fall</td>
<td>Mixtures in the spring</td>
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<tr>
<td>0.0</td>
<td>Variables in the fall</td>
<td>Mixtures in the spring</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Variables in the fall
- Mixtures in the spring
Opportunity to Learn: Learning Activities

- Defining: Variables - 25, Mixtures - 20
- Exemplifying: Variables - 15, Mixtures - 10
- Applying concepts: Variables - 5, Mixtures - 5

Variables:
Mixtures:
Opportunity to Learn: Learning Activities

- Predicting
- Results
- Interpreting
- Res & interpret
- Procedures
- Experiments
- Designing

[Bar chart showing percentages for variables and mixtures]
Opportunity to Learn: Teacher Feedback

• Teachers did not provide feedback despite errors or misconceptions that were evident in the students’ journals.

• Only 4 among the 10 teachers provided feedback!
# Some Findings About Students’ Journals as Assessment Tools

## Reliability
- Raters can consistently identify journal entries
- Students’ science journals can be reliably scored

## Validity
- Inferences about implementation using journal scores were justified
- Inferences about students’ performance were also encouraging

## Usefulness
- Unit implementation and teacher feedback scores helped to explain differences in the performance across classrooms
Conclusions of Classroom Assessment Study

• Science journals can be reliably scored and be used as a valid assessment tool

• Students did poorly in scientific communication and showed partial science understanding in their journals

• Most teachers did not effectively use science journals

• Teachers had very limited content knowledge. They did not know how to promote or assess student learning
Reprise: Journals & Formative Assessment

• Journals are informative to teachers:
  – Surprise: A discussion that “goes well” from teacher’s perspective may have missed its mark when viewed from students’ journals! (Alisia Alonzo, Cal)
  – Provide valid information on student learning

• But teachers …
  – Rarely give feedback to students in their journals and when they do it’s a grade or happy face …
  – Don’t give verbal feedback on journals to the whole class either
  – Give students minimally challenging activities
  – Lack subject-matter knowledge to teach inquiry science
Concluding Practical Advice

• Pick key instructional activities and give feedback in journals
• Use peer review but to do so you must make goals and criteria crystal clear
• Work intensively helping teachers develop their formative assessment practices... perhaps create cadres of teachers to help others
• Establish framework (“schema”) for journal reporting and use consistently but avoid recipes that give information to students
Practical Advice Continued

• Have students respond to “why” questions in journals to develop appropriate mental models (conceptual frameworks)
• Help improve teachers’ content knowledge underlying inquiry units
• Work with teachers on appropriate (how to improve, not grades or happy faces) feedback to students