Measuring Student Readiness as a Means of Evaluating Science Curriculum Reform

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K to 12 curriculum reform in the Philippines

Previous Basic Education Curriculum (BEC)
10-year basic education program
- 6 years elementary education
- 4 years high school

Current K to 12 curriculum
12 years of basic education
- 6 years elementary education
- 4 years junior high school
- 2 years senior high school
New science curriculum

Spiral curriculum
- *Concepts and skills* presented with increasing levels of complexity from one grade level to another in spiral progression to develop deeper understanding of core concepts

• Research question
- Do students enter Grade 7 and Grade 8 with the level of conceptual knowledge and skills they need to engage with the science (Matter) curriculum?
Change from discipline-based to spiral curriculum

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Science Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Earth &amp; Environmental Science</td>
</tr>
<tr>
<td>8</td>
<td>Biology</td>
</tr>
<tr>
<td>9</td>
<td>Chemistry</td>
</tr>
<tr>
<td>10</td>
<td>Physics</td>
</tr>
</tbody>
</table>
K to 12 Science curriculum focus by quarter across grade levels

<table>
<thead>
<tr>
<th>Qtr</th>
<th>Gr 6</th>
<th>Gr 7</th>
<th>Gr 8</th>
<th>Gr 9</th>
<th>Gr 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Matter</td>
<td>Matter</td>
<td>Force, Motion &amp; Energy</td>
<td>Living Things &amp; Their Env’t</td>
<td>Earth &amp; Space</td>
</tr>
<tr>
<td>2</td>
<td>Living Things &amp; Their Env’t</td>
<td>Living Things &amp; Their Env’t</td>
<td>Earth &amp; Space</td>
<td>Matter</td>
<td>Force, Motion &amp; Energy</td>
</tr>
<tr>
<td>3</td>
<td>Force, Motion &amp; Energy</td>
<td>Force, Motion &amp; Energy</td>
<td>Matter</td>
<td>Earth &amp; Space</td>
<td>Living Things &amp; Their Env’t</td>
</tr>
<tr>
<td>4</td>
<td>Earth &amp; Space</td>
<td>Earth &amp; Space</td>
<td>Living Things &amp; Their Env’t</td>
<td>Force, Motion &amp; Energy</td>
<td>Matter</td>
</tr>
</tbody>
</table>
The research design

- Readiness test, not achievement test
- Students were tested directly before commencement of each unit of *Matter* (Chemistry).
- assessment used as a tool to provide information that helps to improve learning rather than a tool used for judgments
Why measure readiness

- Indicates the competency level of students prior to each unit

- Competency level is indicative of the knowledge retained long-term from previous units of that subject.
How readiness was measured

- **Curriculum audit of K to 12 Science**
  - **Prerequisite** concepts identified. These are concepts and skills students *need* to have in order to access a specific grade level in the chemistry curriculum.
  - **Precursors** (ideas that come before the prerequisite concepts) identified to find out what students in each grade level are capable of doing.
Test results

- Student test data collected was calibrated using the one parameter simple logistic model (Rasch, 1960) and student ability estimates were produced.

- Test results show which actual concepts and skills students are ready to learn.

- These concepts and skills were ordered into a series of level descriptions, from easiest to most difficult.
Note: Green = Ready, Gray = Not ready
Pre-Grade 8: Regular High Schools

Note: Green = Ready, Gray = Not ready
## Comparison of student readiness Grades 7 and 8

<table>
<thead>
<tr>
<th></th>
<th>Regular High Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ready</td>
</tr>
<tr>
<td>Pre-Grade 7</td>
<td>39%</td>
</tr>
<tr>
<td>Pre-Grade 8</td>
<td>27%</td>
</tr>
</tbody>
</table>
Curriculum Structure: Grade 8

Two learning competencies

*Explain the properties of solids, liquids, and gases based on the particle nature of matter.*

*Explain physical changes in terms of the arrangement of atoms and molecules.*

Page 49, K to 12 Curriculum Guide: Science
Pre-Grade 8 Level Summaries

Pre-Grade 8: Regular High Schools

Levels

D: ...gases are compressible

C: {nothing regarding solids, liquids and gases}

B: ...particulate nature of matter, e.g. that ice and water are the same substance with different arrangements of particles

A: ...macroscopic properties of solids, liquids and gases

Percentage of students
When you put sugar into water, the solid becomes part of the liquid and cannot be seen. You can say that the sugar dissolves in water or the sugar is soluble in water. Solutions may be solids dissolved in liquids or gases dissolved in liquids. …

“What common properties do solutions have? Are solutions always liquids?”

Learner Materials, p3
Pre-Grade 7 Level Summaries

Pre-Grade 7: Regular High Schools

A: ...identify common solids, liquids and gases
B: ...basic properties of solids, liquids and gases
C: {nothing regarding solids, liquids and gases}
D: ...use their understanding of how matter behaves to make
predictions in real-life settings; that a gas cannot be held in
one's hand,...and that a solid is not always flat
E: ...substances that exist in different states (ice and water)
differ in terms of molecular arrangement
F: ....understand the use of words describing the properties of
matter, including mass, shape and volume

Percentage of students
Possible revised structure: Grade 7

<table>
<thead>
<tr>
<th>Activity 1</th>
<th>Basic properties of solids, liquids and gases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity 2</td>
<td>Making predictions about solids liquids and gases</td>
</tr>
<tr>
<td>Activity 3</td>
<td>Observations of properties of solutions (existing first activity)</td>
</tr>
</tbody>
</table>
Summary

• Readiness of students for the grade level curriculum can be determined by identifying & assessing these types of concepts & skills:
  ❖ prerequisite
  ❖ precursor
  ❖ advantageous

• Inclusion of precursor concepts
  ❖ allows potential changes in curriculum and learning activities to be identified