Research on Mathematics Education

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Achievement
TIMSS Math 1995

U.S. rank order

4th Grade  
8th Grade  
12th Grade
Declared Major
4-year colleges

- Life Sci
- Engineer
- Phy Sci
- Math

%
Tracking and Grouping
Assessment for Instruction
Structured Peer Feedback
<table>
<thead>
<tr>
<th>Constructivist Approaches</th>
<th>Skills-based Approaches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge is constructed</td>
<td>Knowledge is imparted</td>
</tr>
<tr>
<td>Children should develop their own understanding</td>
<td>Children should master standard facts &amp; concepts</td>
</tr>
<tr>
<td>Authentic problems</td>
<td>Skill-relevant problems</td>
</tr>
<tr>
<td>Intrinsically motivated</td>
<td>Extrinsically motivated</td>
</tr>
</tbody>
</table>
Conceptual Understanding
Decimal Fractions

\[ 509 > 7 \]

\[ .509 < .7 \]
Decimal Fractions

0.509

?
Checks on Constructivism

- Many routes to understanding
- Limits on working memory
- Inefficiency of discovery
- Role of work in learning
Average on liking mathematics scale

Average mathematics score

Japan

U.S.

South Africa
Constructivist Math – 3 States

Percentage of possible points

IL Grd 3 | IL Grd 5 | MA Grd 4 | WA Grd 3 | WA Grd 4

Constructivist | Business-as-usual

Legend:
Alignment
4th Grade Math Gains: 1992 to 2000
Elements of State Math Reforms

- State-wide standards
- Linked state-wide assessments
- Accountability for results
Putting It Together
<table>
<thead>
<tr>
<th>Topic</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom-based assessment</td>
<td>+</td>
</tr>
<tr>
<td>Structured peer feedback</td>
<td>+</td>
</tr>
<tr>
<td>Tracking</td>
<td>-</td>
</tr>
<tr>
<td>Understanding</td>
<td>+</td>
</tr>
<tr>
<td>Direct instruction</td>
<td>+ - ?</td>
</tr>
<tr>
<td>Discovery</td>
<td>+ - ?</td>
</tr>
<tr>
<td>Authentic problems</td>
<td>+ - ?</td>
</tr>
<tr>
<td>Work and practice</td>
<td>+</td>
</tr>
<tr>
<td>Curriculum</td>
<td>?</td>
</tr>
<tr>
<td>Implementation</td>
<td>+</td>
</tr>
<tr>
<td>System alignment</td>
<td>+</td>
</tr>
</tbody>
</table>