Do sandbox models help students to visualise geologic structures and deformation?

Analogue sandbox models are cool, but can we demonstrate that they actually aid learning?
- Does seeing structures developing in a 3D volume improve core spatial reasoning skills?
- Can students use their observations to make more geologically realistic predictions of deformation?

**Block Model Test Suggests Improvements in Spatial Reasoning...**

Spatial reasoning skills were assessed using a shortened, 10-question version of the Geologic Block Cross-Sectioning Test (Ormand et al. 2014), administered before and after the sandbox experiments.

Pre-test scores can be divided into high-scoring (>8/10) and low scoring (<8/10) groups. More experienced students were more likely to have better scores.

The average score increased in the post-test, but improvements were not evenly distributed:
- Graduate students (G) showed a small but consistent improvement;
- BS students (BS) improved on average, but degree and direction varied;
- Minor students (M) improved, but to a greatly varying degree.

**DURING EXPERIMENTS PREDICTIVE SKETCHES BECOME MORE REALISTIC DUE TO TRANSFER OF RELEVANT OBSERVATIONS.**

<table>
<thead>
<tr>
<th>Class Experiments - Convergence (basal sugar layer and mid-level glass bead layer)</th>
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<tr>
<td><em>BS students continued to transfer observations about behaviour of sugar layer; but only more experienced student predicted faulting rather than buckling in sand.</em></td>
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<tr>
<td><em>Both students transferred observed symmetry of rift formation.</em></td>
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<tr>
<td><em>Both models not run.</em></td>
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<td><em>Distributive deformation.</em></td>
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<tr>
<td><em>Improved prediction of overall form of deformation but much less detail.</em></td>
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<td><em>Combines observations from both models to improve prediction.</em></td>
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More experienced students clearly drew on their prior geological knowledge and initial sketches, but all students used relevant observations of the experiments that were run to reassess and improve their predictions for the experiments that were not.

**Conclusion:** The predict-compare-revise cycle is an effective framework for using sandbox models to develop spatial reasoning and geological understanding.

- Unlike the block model test, sketches suggest improvements at all experience levels. A more demanding test is needed for expert students.
- A lesson plan that specifically directs students towards relevant observations may further increase effectiveness of this intervention.

REFERENCES


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