



Preliminary Assessment of Active Learning within Groups in an Introductory Earth Science Class



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ABSTRACT

We investigate student learning in a general education, Earth Science course (Earth History, GLY 109) between two distinct cohorts: those students learning through lecture-based instruction and those learning through group activities. Studies suggest that active-learning methods such as those that occur in group-learning activities should outperform more passive types of learning such as those occurring using lecture-based techniques. We test this hypothesis using a series of multiple-choice questions concerning the current geologic paradigm of plate tectonics.

Students involved in group activities generally score lower on the target exam questions. Of 28 questions concerning plate tectonics that appear on the exam, students learning primarily from lecture answer 18 (64%) of these questions with more correct responses. The average percentage of correct responses is 78.6% and 69.2% for lecture-based versus group-based learning, respectively. Moreover, when students in groups do outperform those learning through lecture, the magnitude of that difference is smaller – 5% versus 16.6%. Purging results from questions that perhaps put group-learning at a disadvantage does shrink the gap between the two cohorts, although the lecture cohort (82.3% correct responses) still outperforms the group cohort (77.8% correct responses).

However, these preliminary results are likely unreliable. Only 23 students were involved in group activities, whereas 64 students were exposed to lecture-based learning. We recommend increasing the sample size of students learning through group activities by continuing the study.

SUPPOSITIONS

- Recent pedagogical findings suggest that student learning increases with active vs. passive learning.
- Students processing information in group settings learn more.
- Trends in business indicate that employees with disparate occupations and knowledge will have to pool their expertise to solve problems and overcome business challenges.

BACKGROUND & TESTING

- Examine learning within a general education, Earth Science class, Earth History (GLY 109).
- Compare exam scores of students learning plate tectonics through lecture to those teaching each other through group activities.

RESULTS

- Compare raw exam scores of 23 students learning through group work to those of 64 students instructed by lecture.
- Exam questions are identical and include both multiple choice and matching questions.
- Students learning through group activities score better than the comparison group on only 9 of 27 (33%) questions (Figure 1).
- Disparity (measured as per cent correct) between each cohort is larger when students learning through lecture outperform students participating in group activities (5% vs. 16%).

Figure 1. Graphs comparing the number of correct student answers for 27 exam questions covering aspects of plate tectonics from two student cohorts. Slots representing questions 10 and 21 are spacers only, so do not represent results from a test question.

A. Direct comparison of the percentage of students receiving correct answers for each exam question. Black bars denote students engaged in group learning; white bars show students learning through lecture.

B. Graph showing the percent difference in correct answers from the two cohorts. Bars extending above the medial, horizontal line show students engaged in group activities outperforming students learning through lecture; the opposite case shows better performance from those students learning through lecture.

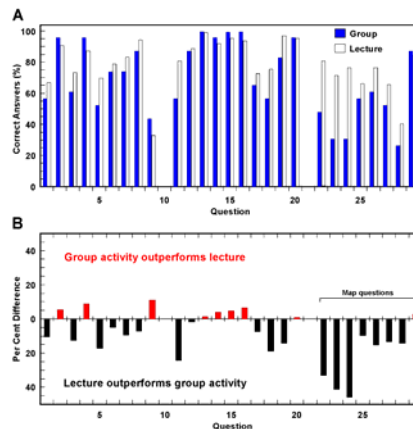


Table 1. Comparison of test scores between all plate tectonic questions versus those not addressing geologic features on a physiographic map of the Earth.

Activity	All Questions		Set 3 Eliminated	
	Average Score	Standard Deviation	Average Score	Standard Deviation
Group	69.2%	23.2%	77.8%	19.2%
Lecture	78.6%	15.9%	82.3%	15.6%

DISCUSSION

- Results are opposite to that of the desired outcome – students learning through lecture perform better on exams than students participating in group activities.
- However, students engaged in group activities perform much worse on a third set of questions (numbers 22 to 29, Figure 1). These questions expect students to recognize geologic features associated with plate tectonic process on a physiographic map – an expectation perhaps not addressed by the group exercise.
- The differences between cohorts shrinks when results from the map questions are jettisoned.

PRELIMINARY FINDINGS

- Group activity appears to be less effective than learning as individuals via lecture.
- Caveats: these initial results are almost certainly invalid due to:
 - (1) the small number of students evaluated by their group activities (23) versus that of the control or comparison group (64);
 - (2) the effect of the third set of questions.

FURTHER WORK

- Continue data gathering for an additional three to four semesters to reach statistical parity with comparison group.
- Include feature recognition within the group exercise.
- Test results with appropriate statistical measures.

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