THE IMPACT OF LEARNER GENERATED DRAWINGS ON THE COMPREHENSION OF EARTH SCIENCE CONCEPTS

Tom Temple, Dawson County High School, Glendive, Montana

MONTANA STATE UNIVERSITY MSSE

GPS GLENDIVE PUBLIC SCHOOLS

Introduction and Background

- Dawson County High School (DCHS) is located in the Eastern Montana rural town of Glendive.
- Enrollment at DCHS is 360 students in grades 9-12 with 26% receiving free and reduced lunch.
- This study was conducted with 9th grade Earth science students (*N*=95).
- I have always noticed that individuals who really understand their subject well, like doctors, electricians, mechanics, professors and teachers, etc. are good at making simple illustrations to convey their ideas. I wanted to see if drawing was a means by which my students could understand Earth science concepts in a deeper way.

Research Questions

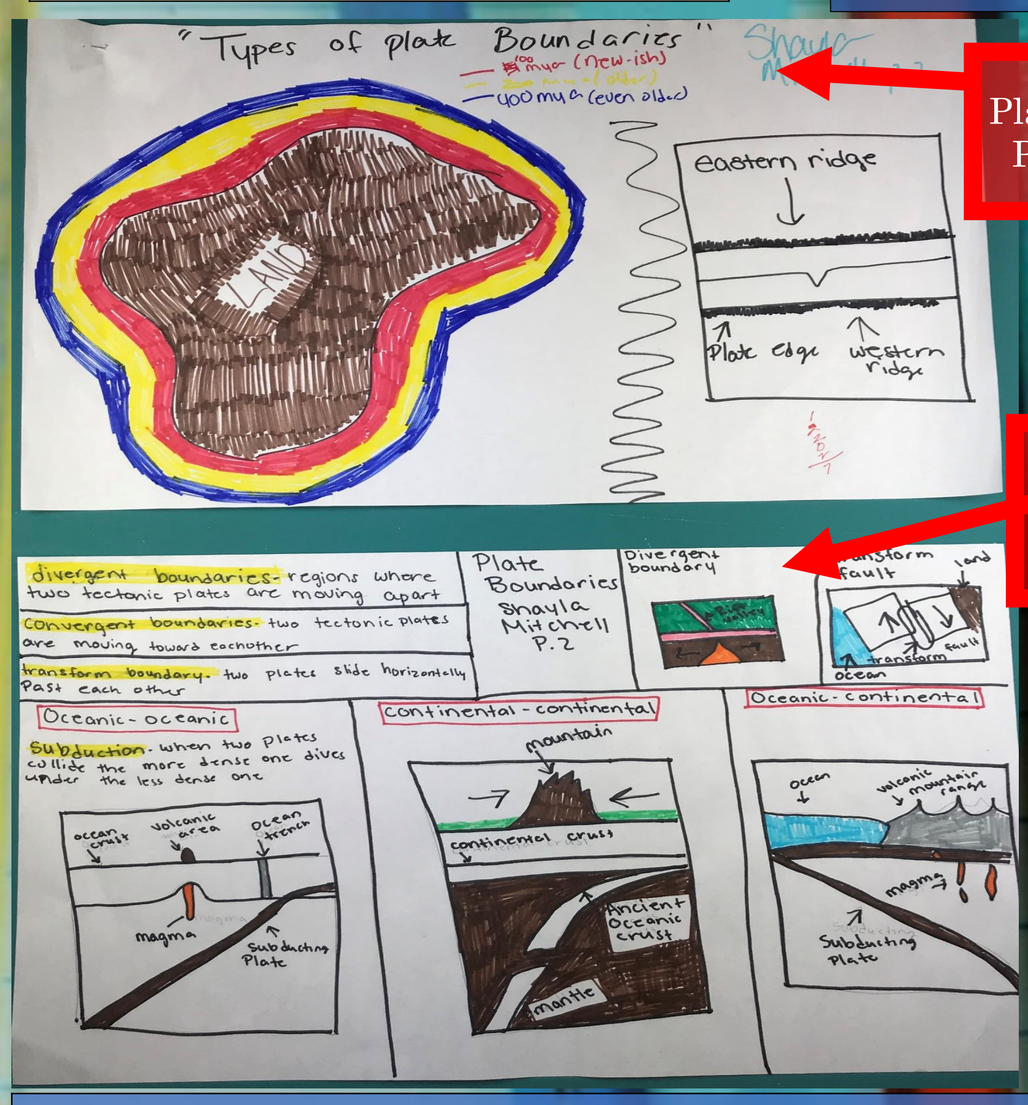
1. How does the use of drawing impact comprehension of Earth science phenomena?
2. Can students improve in their ability to create scientific drawings?
3. Will students change their attitude toward drawing as a learning tool?
4. How will drawing impact engagement and enjoyment of Earth science?

Treatment Methods

- Four treatment periods with two treatment groups.
- Non-treatment groups given readings and lecture notes using power point.
- Treatment groups were asked to create a pre-drawing to assess prior knowledge. Post-drawings were then constructed after the same reading passage as the non-treatment group.
- Both groups were given the same quizzes and pre and post tests to compare treatment to non-treatment.
- Drawings were scored with a Science Drawing Scoring Checklist to measure improvement in drawing from treatment start to finish.

Student Work Examples

Plate Tectonics Pre-drawing



Stream Development Pre-drawing

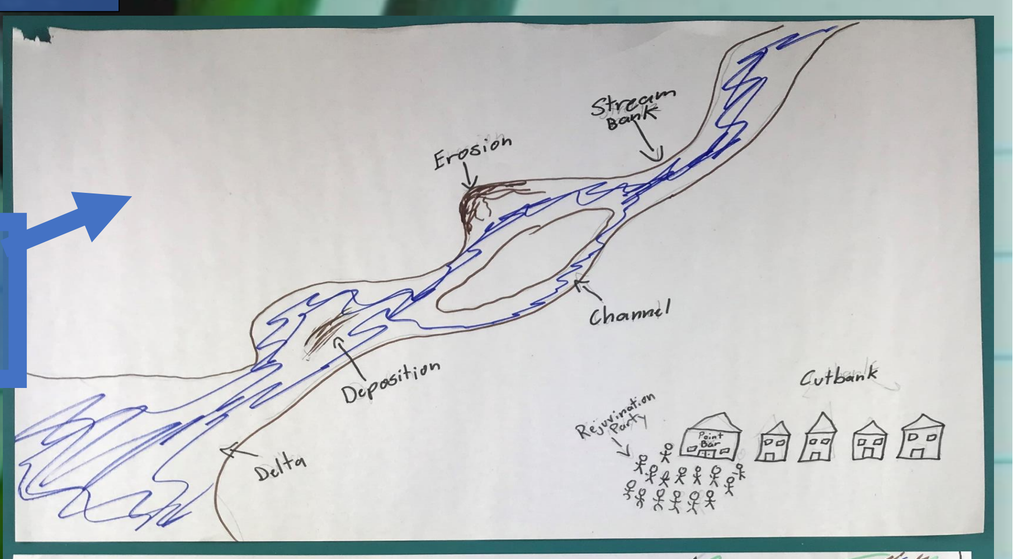
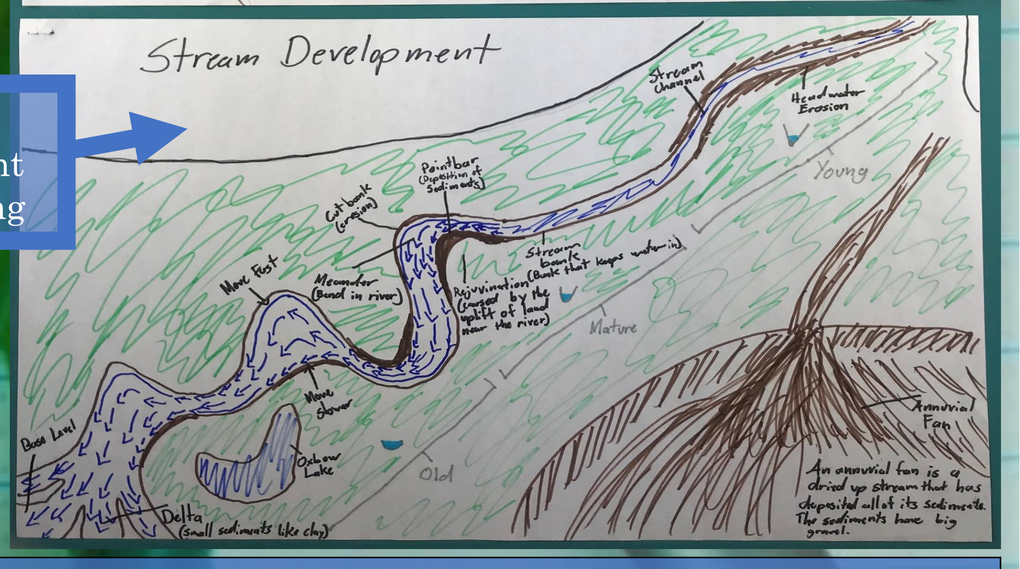


Plate Tectonics Post-drawing

Stream Development Post-drawing



Quantitative Data

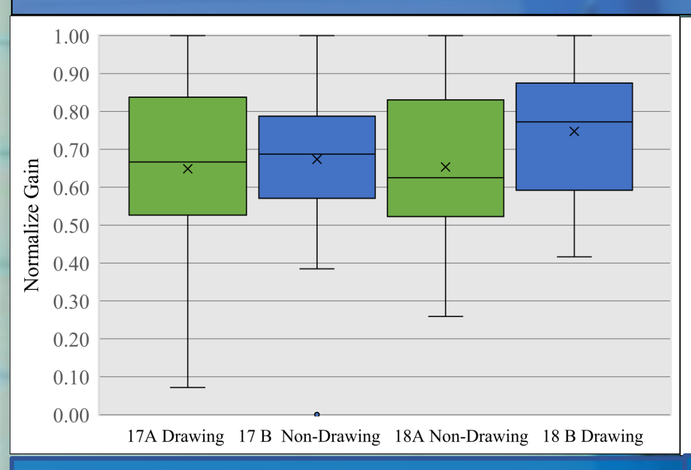


Figure 1. First treatment post-test box and whisker plots. Group A is green, Group B is blue. X indicates mean scores (*N*=86).

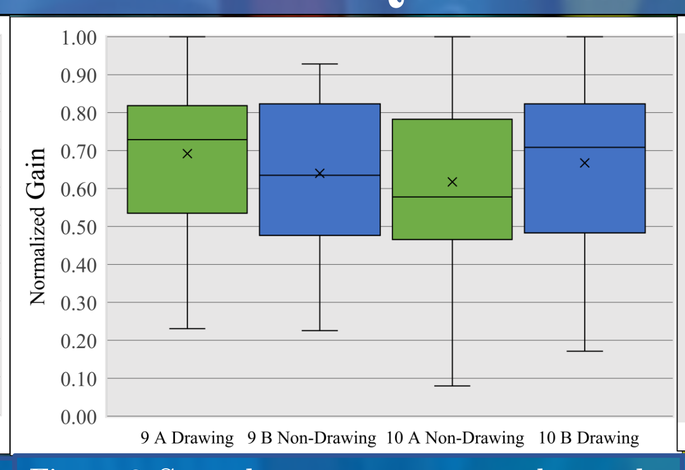


Figure 2. Second treatment post-test box and whisker plots. X's show mean scores are higher on post-test following drawing (*N*=86).

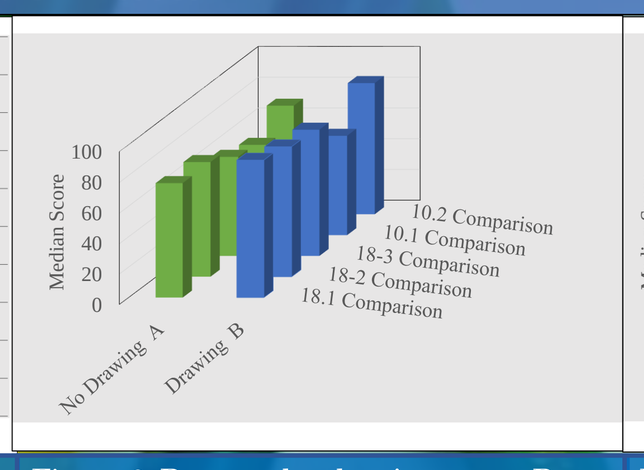


Figure 3. Bar graphs showing group B median scores were higher on section quizzes where they drew (*N*=86).

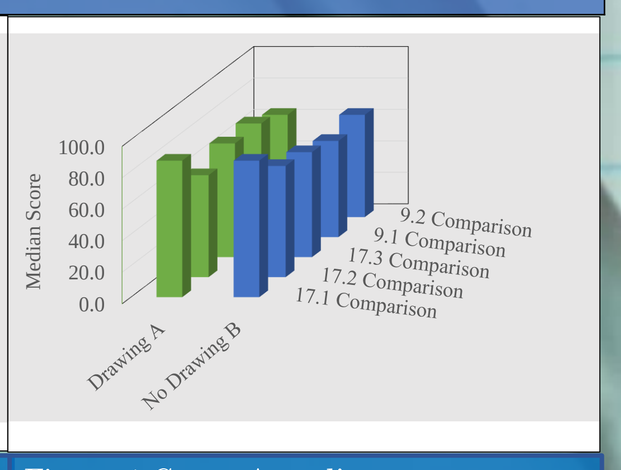


Figure 4. Group A median scores were higher 80% of the time on section quizzes after drawing (*N*=86).

Qualitative Data

Behavioral tendency measured.	P-Value	Probably not / Possibly / Probably / Very Probably
Draw diagrams shown in lecture notes.	0.617	Drawing Survey 2 / Drawing Survey 1
Draw because it energizes my thinking.	0.183	Drawing Survey 2 / Drawing Survey 1
Draw to map out spatial ideas or design something.	0.109	Drawing Survey 2 / Drawing Survey 1
Use diagrams from textbooks to help be understand the reading.	0.889	Drawing Survey 2 / Drawing Survey 1
Use drawings to communicate ideas.	0.034	Drawing Survey 2 / Drawing Survey 1
Pay close attention to the scale of objects I'm drawing.	0.303	Drawing Survey 2 / Drawing Survey 1
Sketch out ideas to study for tests.	0.002	Drawing Survey 2 / Drawing Survey 1

0% 20% 40% 60% 80% 100%

Figure 5. Pre- and post-treatment Likert survey questions were used to measure student attitudes about drawing as a learning tool.

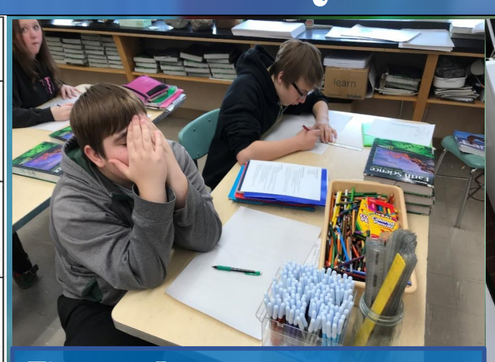


Figure 6. Instructor observations were kept in a journal. The left photograph shows drawing was a challenge for some.

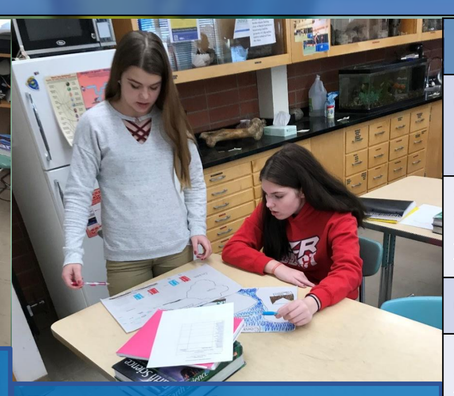


Figure 7. Students were asked to share their drawings with classmates to compare ideas.

Interview Responses

Q. Do you like using drawing to learn Earth science topics?
Boy 1. Yes. It always kept things interesting and fun.
Girl 1. Yes. It was less boring than taking notes.
Boy 2. When I draw I could see my drawings in my head on the test.
Girl 2. Yes and No. I still like the notes and would go online to get them.

Interpretation and Conclusion

When compared to traditional direct instruction using reading, discussion, and presentation notes it can be concluded that drawing did improve student comprehension based on post-test and quiz scores. It is important to note that of the two treatment groups, Group A, came into the study with a nearly 5% lower average median score for their semester one test grades. For treatment to prove effective that means Group A should have either caught up to or surpassed Group B on post-test scores immediately following treatment, which was the case in both treatment sessions.