

Legends, Lines, Learning:

GIS Map Focused Curriculum and Its Effect on Student Learning and Engagement

By Katherine W. Hodge, July 2022

Bozeman, Montana

Data Analysis

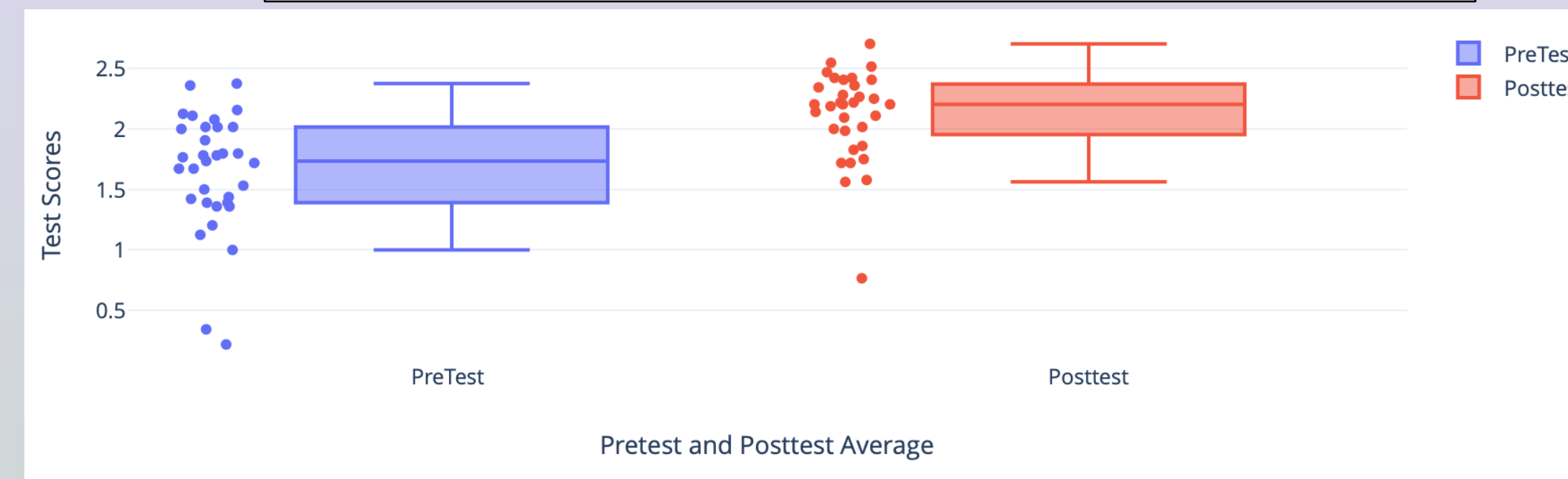


Figure 1. Box and whisker plot of the treatment group's pre and posttests. ($N=33$) This box and whisker plot shows overall student improvement and highlights the success and value the treatment. For example, one teacher explained: "I think the value is great...I love the technology piece within it. The story [GIS] map is awesome. I love connecting it to the modern, you know, clashes with landowners and the wind farm." Additionally, the effect size was calculated to be .96. This plot shows the positive impact of the curriculum and maps on student learning.

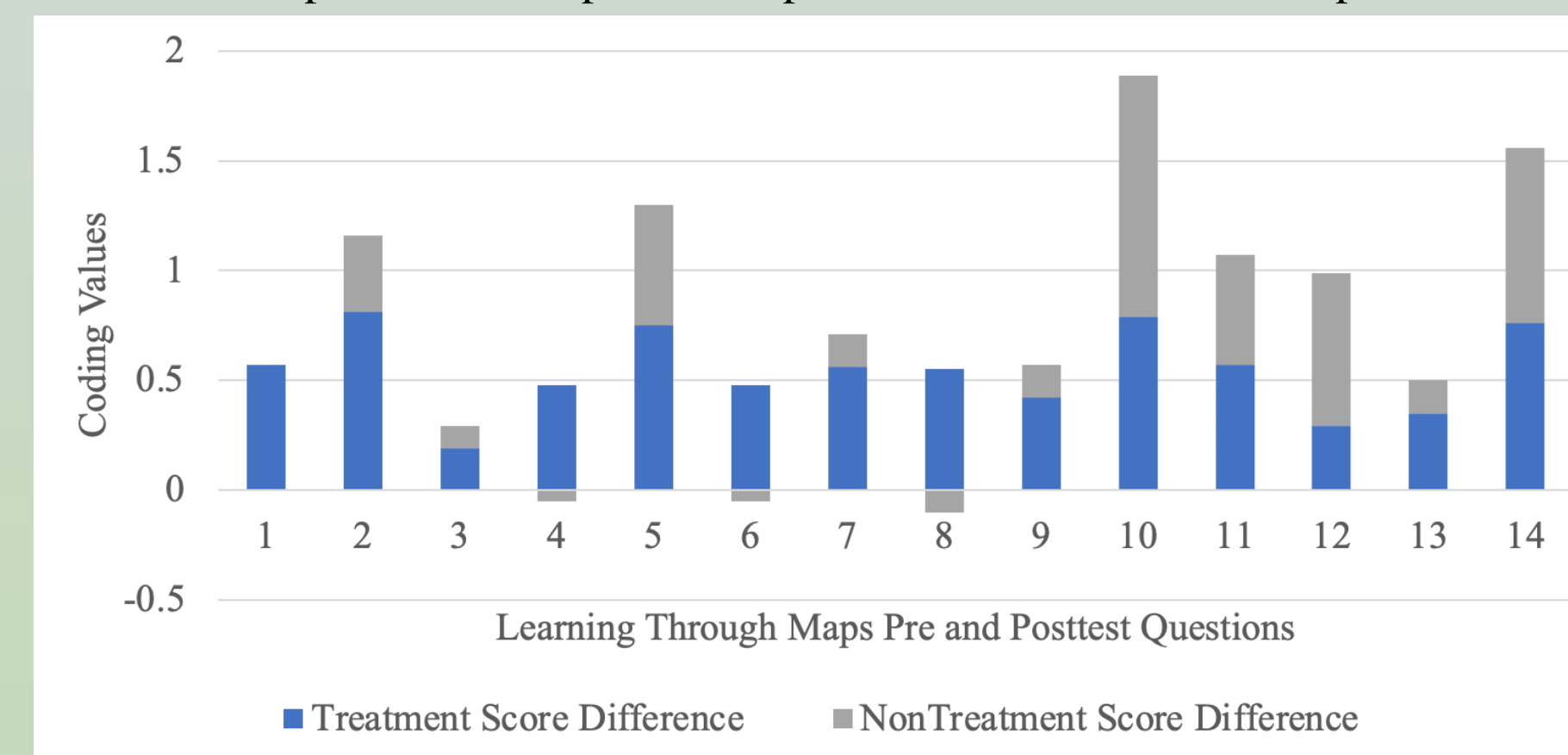


Figure 2. Treatment and nontreatment score difference from pre to posttest. ($N=53$) This graph shows the difference between pre and posttest scores for the treatment and nontreatment groups. 90% of treatment students improved from pre to posttest ($N=33$). Of those students, 53% improved by between 0 and .5, 30% improved by between 0.5 and 1, and 13% improved by more than one. Seventy-five percent of nontreatment students improved from pre to posttest ($N=20$). Of those students, 65% improved by between 0 and .5, 10% improved by between .5 and 1, and 0% improved by more than one. The test questions had average improvement of .54 in the treatment group, and 71% of the questions with above-average improvement were mapping questions. There was an improvement of .27 in the nontreatment group, and of the six questions that had above-average improvement, only 33% were mapping questions.

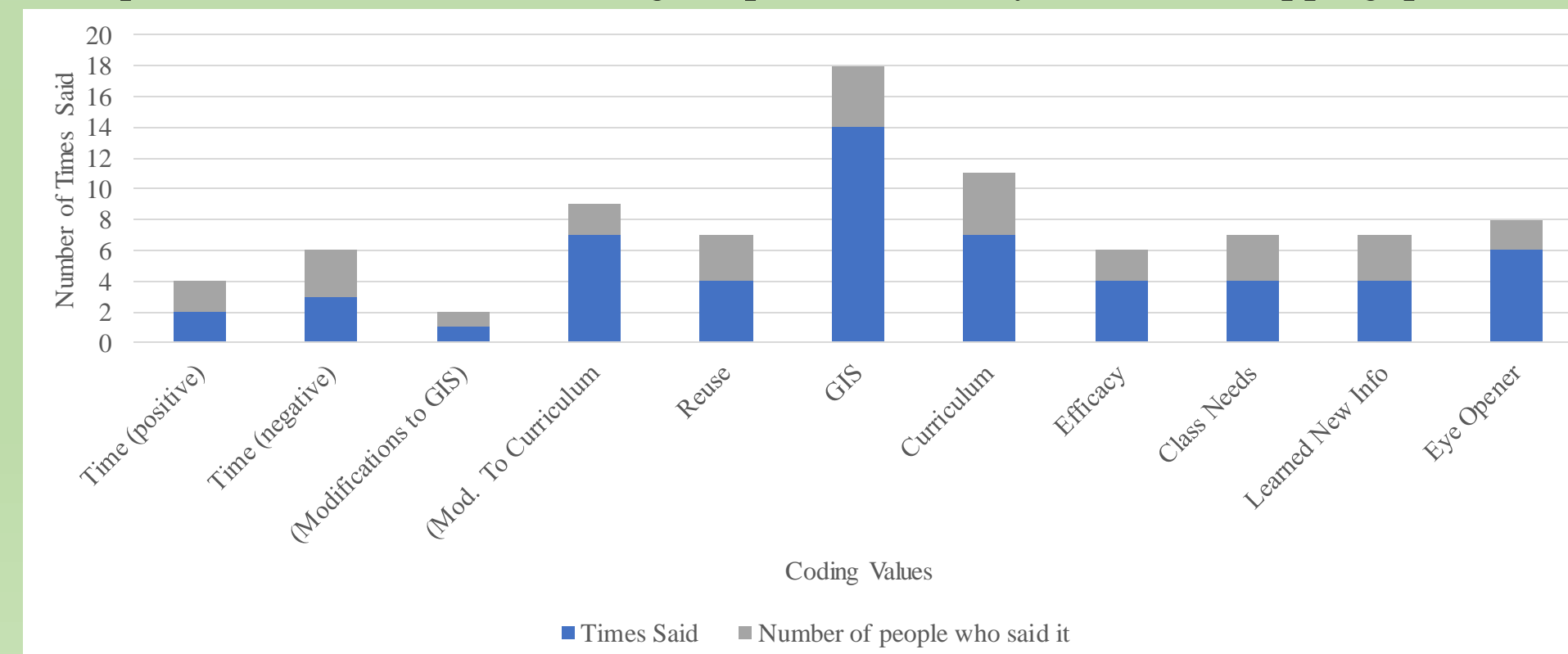


Figure 3. Teacher roundtable discussion coded values ($N=5$) Teachers thought it excelled at teaching the material and appreciated the cross-curricular components. One hundred percent of the feedback on modifications concerned the written curriculum, not the maps. All teachers found extreme value in the curriculum, citing the GIS component the most, the eye-opening moments that the GIS maps enabled, as well as the curriculum overall, one said: "they [the students] had some amazing discussions and it [GIS maps] definitely...opened their eyes a little bit more." One teacher explained: "...the more history, the more math, more writing that you bring into science...for them to recognize that everything is all connected together, the more important it is."



Introduction

Maps have been used in classrooms as teaching tools around the world for thousands of years. New technology, like GIS (Geographic Information System), have become more accessible tools for teaching students geography and history. As a result, there is a growing trend of using these types of resources in the classroom. This study will work to understand if digital maps are valuable teaching tools and if they improve student learning.

Focus Question

Does GIS mapping technology have a positive effect on teacher and student learning experiences, student engagement, and mastery of curriculum material?

Methodology

This study was conducted in five 7th and 8th grade level classrooms in Montana and Wyoming. Data was collected through:

- Learning Migration Through Maps Pre and Posttest
- Teacher Roundtable Questionnaire Discussion
- Classroom Observation

Qualitative data was organized into common themes and analyzed. Pre and posttest open-ended questions were coded on a scale of 0 to 4 then analyzed with mean, effect size, and normalized gain.



Conclusion

Through piloting the GIS-focused curriculum, gathering data, and analyzing results, this study found that students learned and retained more information by using digital mapping resources, like ArcGIS, than with traditional curriculum. The treatment group improved by 90%, and 71% of the questions with above-average improvement were mapping questions. These results are further emphasized by the qualitative data. Teachers observed students learning more deeply, turning in higher-quality work, and even experiencing aha or eye-opening movements thanks to digital maps' ability to layer information in a way student had never experienced. This study demonstrated the value of use GIS in the classroom through its ease of integration, ability to engage, and its ability to improve the learning experience.

References

- McDermott, P. D. (1969). What Is A Map? *Journal of Geography*, 68(8), 465–472.
<https://doi.org/10.1080/00221346908981165>
- National Geographic Society. (2012, October 9). *Map*.
<https://www.nationalgeographic.org/encyclopedia/map/>
- Van Cleef, E. (1948). What Is a Map? *Science*, 108(2811), 521–522.
<https://doi.org/10.1126/science.108.2811.521>