



Use of Claim, Evidence, Reasoning Framework in a Middle School Classroom

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Abstract

The implementation of this research project was done in a my 6th grade Earth Science classroom. I chose to focus my research on students' ability to write scientific explanations after science investigations. I implemented the instruction of the CER (claim, evidence, reasoning) framework to help improve my students' scientific reasoning skills and confidence while writing scientific explanations.

Introduction

During learning experiences students were struggling with written explanations of science concepts. This was a concern because written reasoning, explanations, and conclusions are a key part of any science instruction (Short, Van der Eb, & McKay, 2020). I saw a need to implement writing instruction into my science classroom to address this concern, and to foster deeper understanding during science lab conclusions. The goal was for students to make connections between science content and lab experiences by making claims, and supporting those claims with evidence and reasoning. To reach this goal, I implemented the CER writing framework to help students organize their science writing.

Focus Questions

How does the direct instruction and repeated use of the CER framework impact students' scientific explanations after scientific investigations?	Will the use of the CER framework increase the use of evidence to support explanations in lab write-ups?	How does the CER framework of writing affect students' attitudes towards scientific writing?
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Methodology

The purpose of my study is to determine if the Claim, Evidence, Reasoning (CER) framework of writing impacts student's scientific explanations. I gathered qualitative data through interviews, and surveys (Mertler, 2020). The qualitative data focused on the participants' reactions and personal experiences. I gathered quantitative data by grading a pre and post writing assessment. The instruments included a Pre and Post Intervention Survey, a Pre and Post Student Interview, and a Pre and Post Writing Assessment.

During my analysis of this qualitative data, I analyzed the students' answers carefully and tried to work towards generalized and plausible relationships between results (Marvasti, 2014). While reading through transcripts and listening to students' experiences I looked closely and worked carefully to reach conclusions and plausible inferences. I used a Pre and Post Writing Assessment to collect numerical data. Analyzing these results and using a proficiency scale (CER Rubric) was a key part to the conclusions I made during my study.

Pre- and Post- Self-evaluation Survey Confidence Results
Note. Confident students = answered confident or very confident with the statement. (N=51)

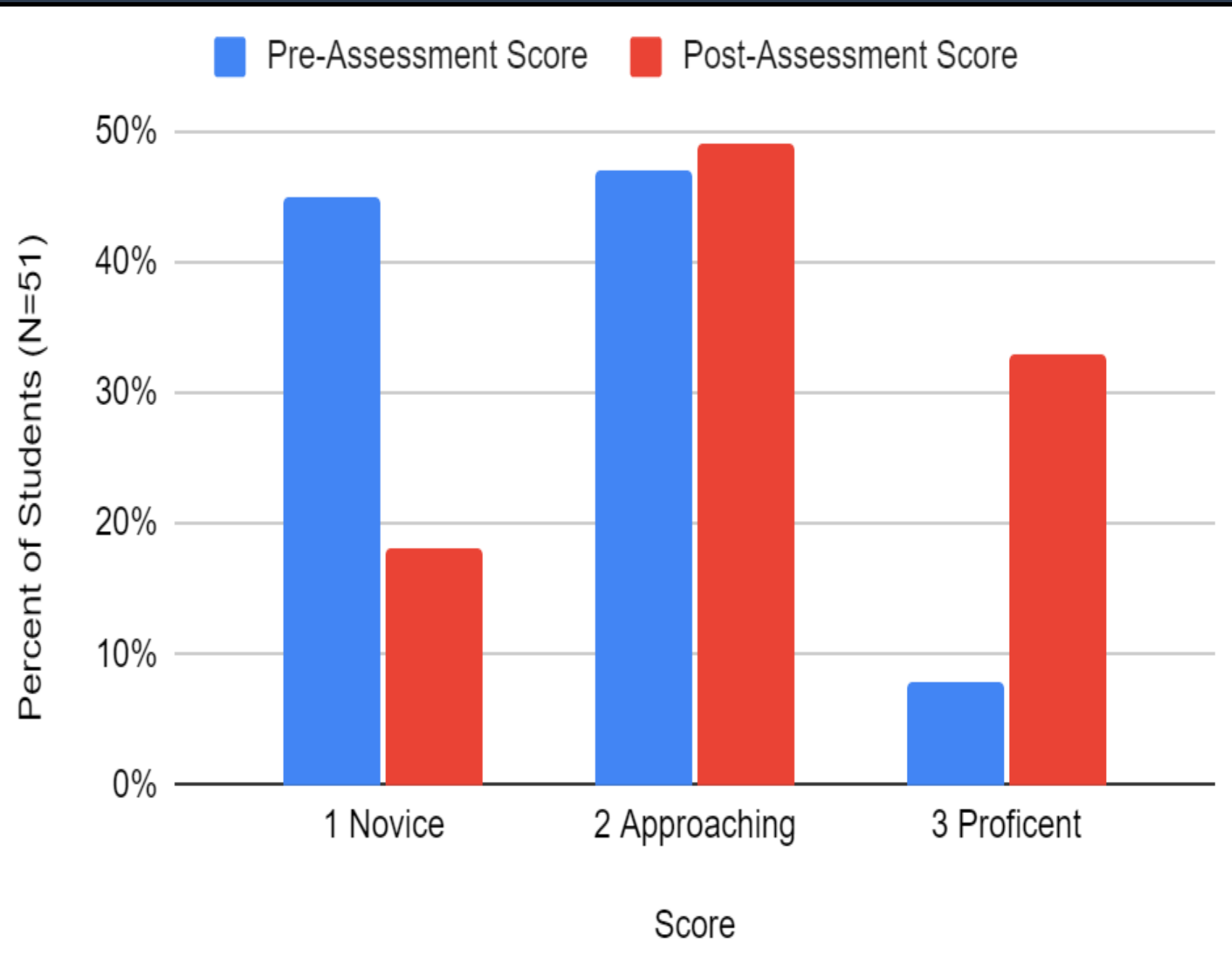
	Pre Treatment (%)	Post Treatment (%)
I feel confident when writing about science topics.	35	55
I am confident in my ability to write a claim in a scientific investigation (lab).	47	67
I am confident in my ability to use evidence to support my claim in a scientific investigation (lab).	61	76
I am confident in my ability to use reasoning that links my evidence to my claim in a scientific investigation (lab).	49	71

Results

By using this proficiency scale, I was able to determine that students did improve on writing scientific explanations. The pre-treatment writing assessment mean score for CER writing was 1.6 and the post-treatment writing assessment mean score was 2.1.

After the treatment, students increased their use of evidence to support their explanations. In the pre-treatment writing assessment 55% of students used or cited evidence, compared to the post-treatment writing assessment, where 82% of students used or cited evidence.

When evaluating results of the Likert survey regarding students' confidence levels, in all areas students' confidence levels increased. When specifically looking at their confidence when writing about science topics, this percentage increased post-treatment by 20%.



Conclusion

I concluded that students' writing benefitted from the CER framework. Overall, students' writing improved based on the post-assessment scores and the frequency at which students used evidence. However, there was a discrepancy between the impact on students' explanation writing and the specific part of the question – the impact it had after investigations (labs). Even though there was a positive impact on students' use of evidence, there was no indication of impact between lab explanations and content learned in class.

Students' survey answers indicated that they were more aware of evidence being an important element to scientific writing, and in their post-treatment writing assessment there was an increase in the use of evidence. In the post-survey students reported evidence as being a crucial part of a scientific explanation. In the post-writing assessment there was a significant increase in students scoring a 2 or 3 because they used evidence in their explanation.

Lastly, when evaluating if CER writing would affect students' confidence towards scientific writing, students reported feeling more confident post-treatment. These results are seen in the Likert survey results. In the Likert survey, there was an increase in the percentage of students feeling confident or very confident. Also, during post-treatment interviews students reported feeling more confident in their use of evidence during scientific explanation writing.

CER Writing Proficiency Scale

Proficient - 3	Approaching - 2	Novice - 1
The claim is specific, accurate and answers the research question completely.	The claim is mostly accurate and mostly answers the research question.	The claim is inaccurate or incomplete and does not answer the research question.