



What effect does the Claim-Evidence-Reasoning (CER) framework have on learning in a middle school classroom?



Allyson Reamy

Columbia Falls Junior High School, Columbia Falls, Montana

Background

I conducted my research at Columbia Falls Junior High School in Columbia Falls, Montana. At the beginning of this research, my students lacked the ability to draw conclusions based on lab observations as well as construct arguments based on evidence. The purpose of this research was to successfully implement the claim-evidence-reasoning (CER) framework in my seventh grade classroom in order to raise student interest and create a classroom in which students experiment and build with things in the classroom, and learn real-world skills that scientists and engineers, who discover knowledge and problem solve, use to answer questions and solve problems objectively.

The CER framework teaches students to think at a deeper level of inquiry that they need to be successful academically and in the real world. Students who are provided with lab experiences that promote inquiry, ask questions, and draw conclusions are provided with a natural bridge to exploration in other content areas as well as shown how to think critically in developing reasonable explanation. My research focused on improving students ability to develop their CER skills and how that impacted their attitudes toward the middle school science classroom.

Research Questions

What effect does the Claim-Evidence-Reasoning Framework have on learning in a middle school classroom?

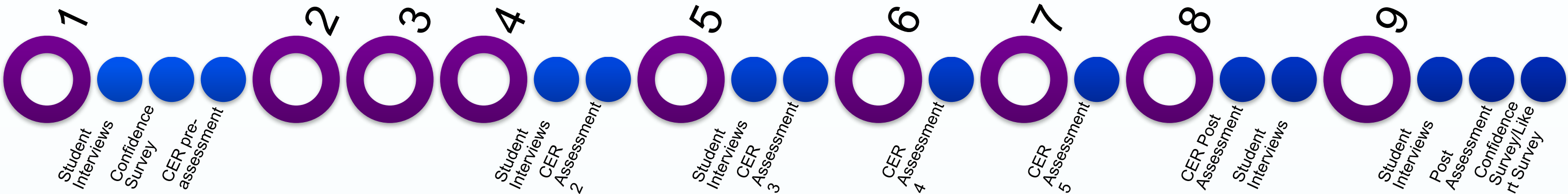
How do I develop students' ability to consistently create better scientific explanations and arguments?

Does Claim-Evidence-Reasoning (CER) Framework improve the frequency of evidence used to support conclusions in lab reports?

How does the CER Framework affect student attitudes toward science?

Is the CER Framework allowing students to feel empowered to explore investigative questions of their own?

Treatment Timeline

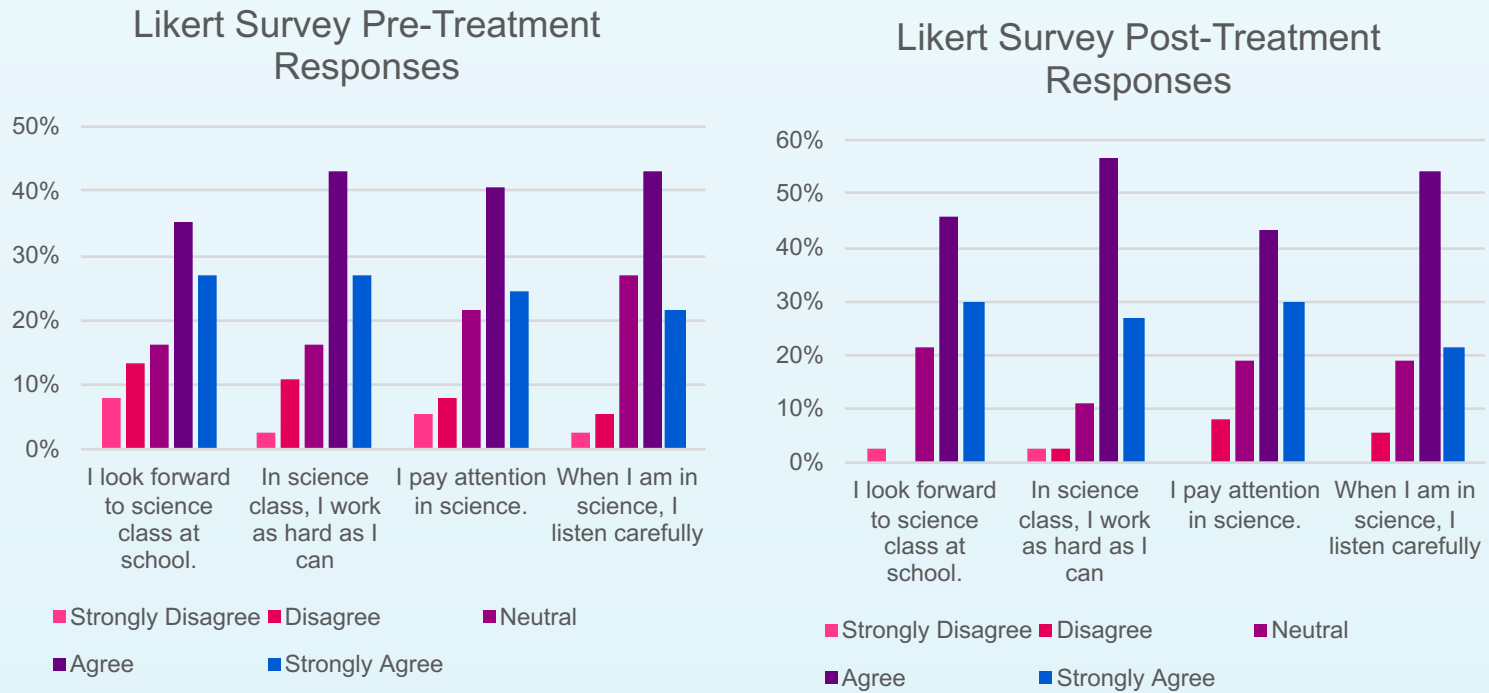


Data Collection

Research Question	Data Source	Data Source	Data Source
How do I develop students' ability to consistently create better scientific explanations and arguments?	CER Rubric	Student interviews	
Does Claim-Evidence-Reasoning (CER) Framework improve the frequency of evidence used to support conclusions in lab reports?	Inquiry Lab Reports	CER Rubric	
How does the CER Framework affect student attitudes toward science?	Student Interviews	Confidence Survey	Likert survey
Is the CER Framework allowing students to feel empowered to explore investigative questions of their own?	Student Interviews	Likert Survey	

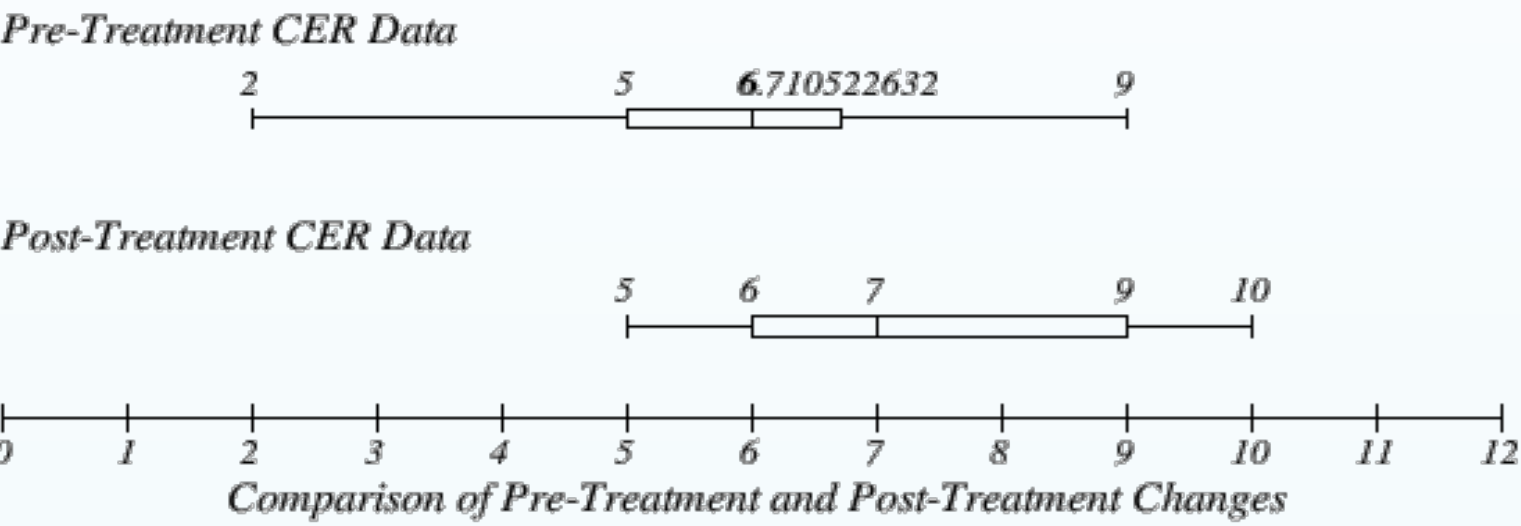
Throughout the course of the treatment, I was able to construct regular lessons within the unit, informally assessing students through individual and class discussions, as well as science notebooks. Self-confidence and Likert surveys were administered pre- and post- treatment to gauge student attitudes toward science and their current level of skills. Student interviews were conducted with open-ended response questions to measure the effect of the intervention on scientific understanding and students' motivation.

Attitudes Analysis

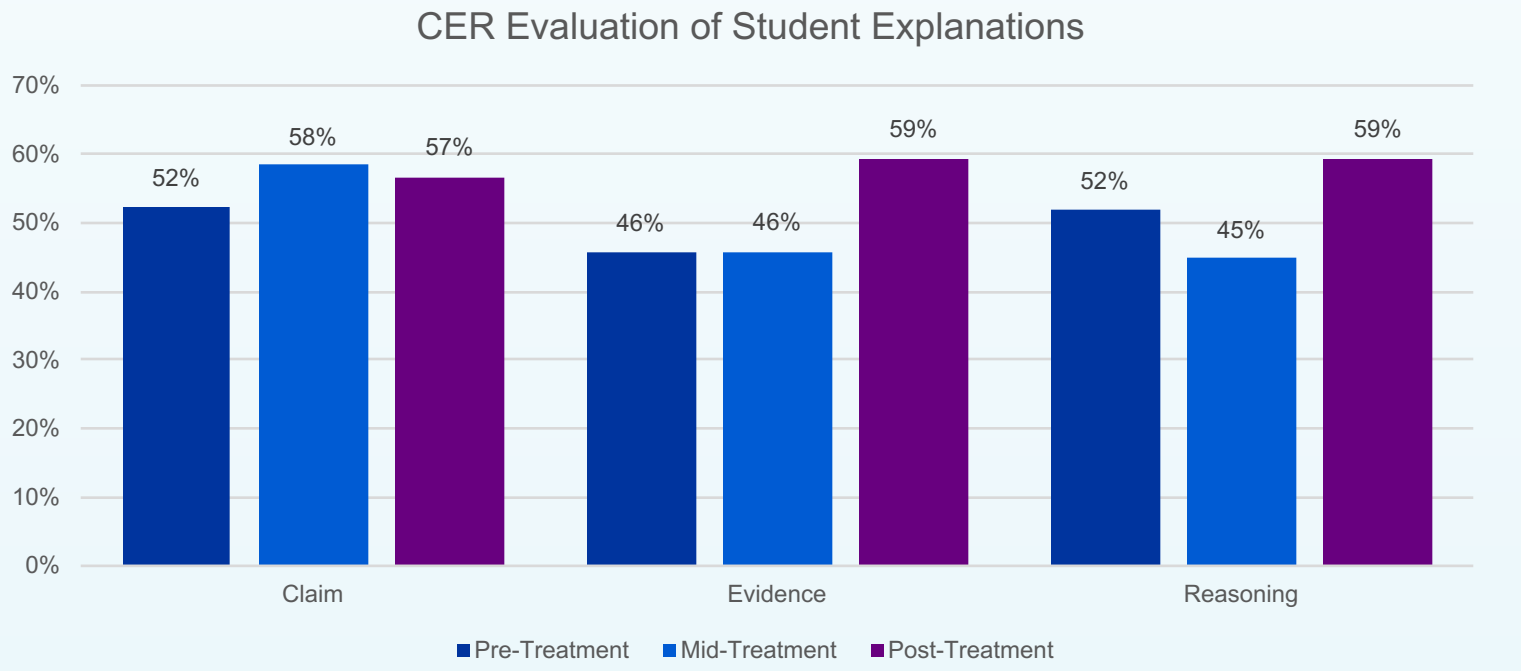


Students responded 81% of the time post-treatment (N=32), that doing experiments in science class is not frustrating. This is compared to 21% of students feeling this way prior to the treatment

Claim-Evidence-Reasoning Analysis



The results show an overall increase in student ability to make evidence based claims. Pre-treatment there was a large range of CER responses, as compared to post-treatment which supports the idea that students who began with little to no understanding of the framework saw great improvement over the course of treatment.



Emphasis was placed on understanding why including useful evidence from the lab itself was important. Students had difficulty with the ability to use scientific principles in their reasoning but they were able to utilize individual lab components to be able to make accurate descriptions from their work.

	Calculated Normalized Gain	Statistical Significance
Claim	0.055	Not statistically significant
Evidence	0.175	Statistically significant
Reasoning	0.073	Not statistically significant

Throughout the course of treatment, students did not make large gains in the ability to create claims that consistently were accurate and complete. Students made major progress in their ability to provide sufficient evidence to support their claims however, gaining the ability to include measurements or observations that had been analyzed and interpreted to support their claim with a 7% overall gain in students' ability to correctly reason as to why the evidence is included or how it supports the claim in their reasoning.

Interpretation and Conclusions

What effect does the Claim-Evidence-Reasoning Framework have on teaching and learning in a middle school classroom?

- Students gained confidence in their ability to make evidence-based conclusions that supported a claim.
- 36% of scores on the CER rubric increased from pre- to post-treatment.
- Students reported that making connections through lab activities helps them to learn.

How do I develop students' ability to consistently create better scientific explanations and arguments?

- Students saw a 13% increase in their ability to focus on using quality evidence when writing explanations of scientific phenomena.
- The number of explanations that focused on confirming predictions was reduced.
- Students became better able to think critically.

How does the CER Framework affect student attitudes toward science?

- Initially, students believe that science class had a lot of details and it could be difficult because there were so many new words.
- Post-treatment saw an 11% positive change in attitudes towards this idea.
- During treatment, students were working hard to create better explanations and arguments based on real-world application.

Does the CER Framework allow students to feel empowered to explore investigative questions of their own?

- Students didn't ask questions that would've helped them to further their thinking to explore questions of their own.
- Students however, did gain a stronger interest in science, a better attitude towards the subject.
- Students also gained the confidence to want to excel at science over the course of treatment.

Implications for Future Planning

I will continue to use the CER framework in my daily classroom routines. I also will be weaving in more project-based learning opportunities. This will give students more applicable opportunities to learn and allow me to step back from a teacher-led classroom to a student-led classroom. By doing this, students will be moving into high school with good science habits and a positive relationship with science.

Additionally I hope to be able to help my colleagues feel empowered to implement this framework in their classrooms. By bringing this knowledge to my team, I feel that there would be more positive relationships established between teachers and their students.

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