

Background

Students could not engage much in authentic science experiences during the pandemic, which created gaps in student learning around critical science & engineering practices (SEPs). These gaps were especially harmful to the most vulnerable student populations at the school where the study was conducted, where 63% are students of color and 70% are socioeconomically disadvantaged. To address these gaps, at-risk students were enrolled in a summer school program designed to give students experiences to practice using and improving the SEPs of planning and carrying out investigations, analyzing and interpreting data, and constructing scientific explanations.

As the district science teacher on special assignment (TOSA), I worked as a consultant alongside two teachers that developed the summer school program. The program utilized the Identify and Interpret (I^2) strategy to improve students' ability to analyze and interpret data from investigations and the claim, evidence, and reasoning (CER) framework to improve students' written explanations. This study aimed to examine whether the I^2 strategy would also help improve students' written explanations, specifically with including appropriate and sufficient evidence and reasoning, as these are areas in which students historically struggle.

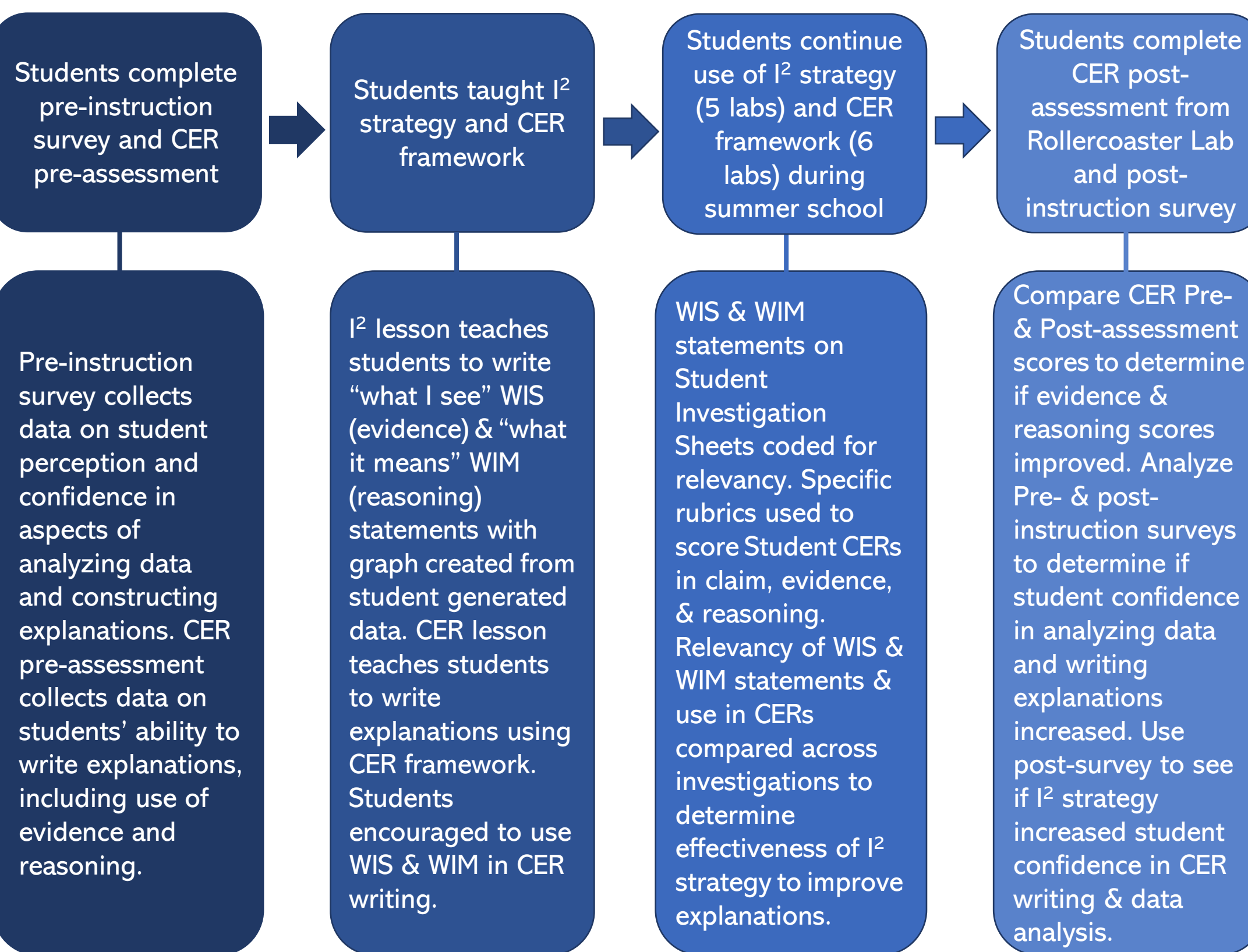
Research Questions

Focus Question: What is the impact of using the Identify and Interpret strategy in a summer school program on improving students' ability to write scientific explanations?

Sub-questions:

- How effective is the Identify and Interpret strategy in improving students' use of appropriate and sufficient evidence when writing scientific explanations?
- How effective is the Identify and Interpret strategy in improving students' reasoning when writing scientific explanations?
- What impact does using the Identify and Interpret strategy have on students' confidence in writing scientific explanations?

Methodology



Data Analysis

Overall Impact on Explanations

- Initial data analysis revealed students did not show improvement in claim or evidence scores between pre- & post-assessments. Students did show slight improvement in reasoning scores with average increasing from 22% to 29% ($N=25$).

Impact on Evidence & Reasoning Scores

- Data grouped by students that used WIS & WIM statements in their CER (Group 1) and those that did not (Group 2) showed, on average, Group 1 scored consistently higher in evidence and reasoning.
- Post-assessment data showed when students write relevant WIS statements using I^2 strategy (70%, Group 1) and use as evidence in explanations, average evidence score is significantly higher (58%) than students that don't (29%).
- Student survey data showed 68% agreed writing WIS statements improved use of evidence in explanations. Students stated, "what I see is like identifying evidence" and "the "what I sees" helped me use more evidence to complete the C-E-R."
- Student survey data showed 72% agreed writing WIM statements improved use of reasoning. Students stated, WIM is "stating in your own words what the graph means and what's happening and why it's happening," and "it helps use the right words to explain."

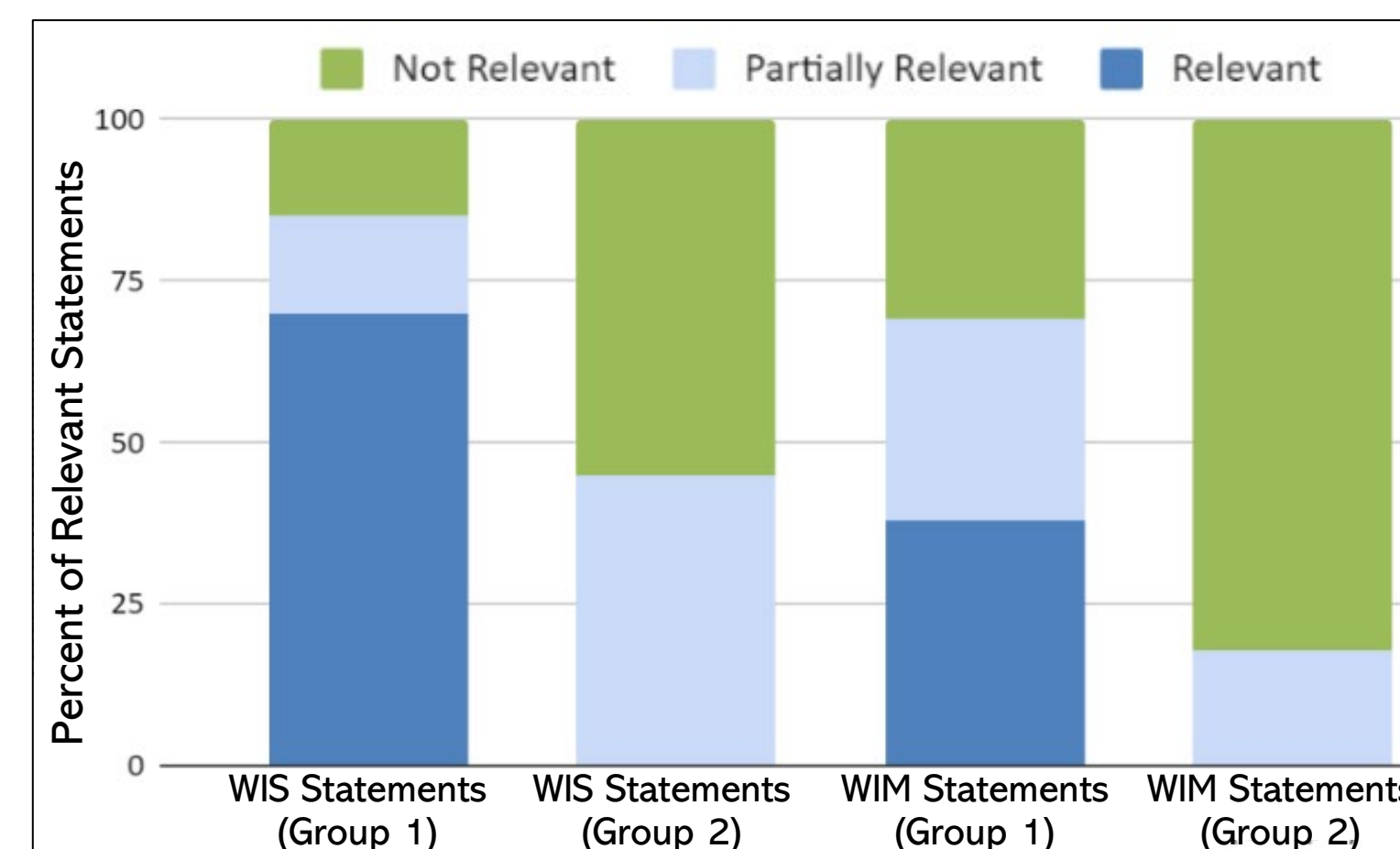


Figure 1. Percent of relevant WIS and WIM statements from post-assessment observational data, group 1 ($n=13$) and group 2 ($n=11$).

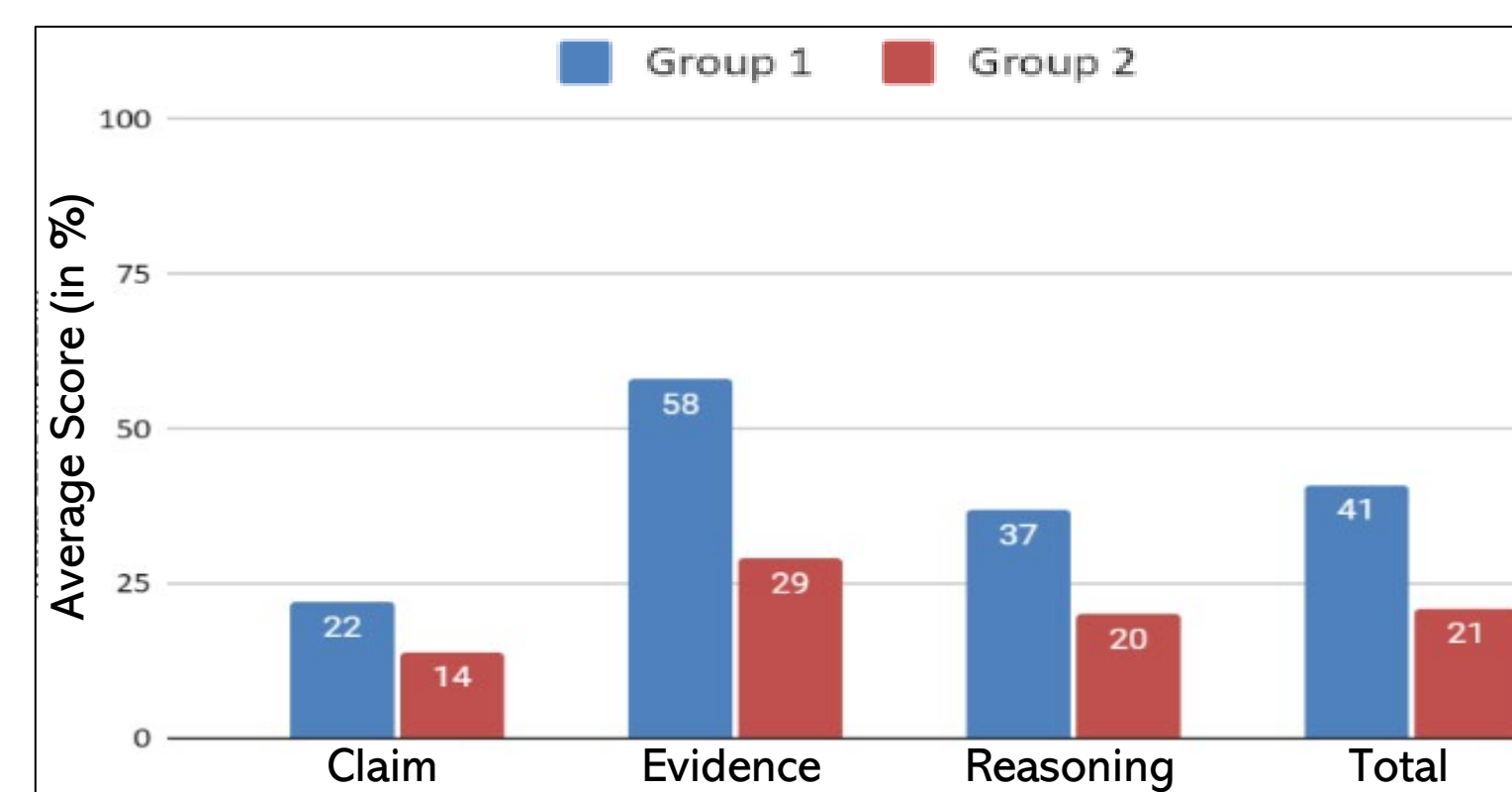


Figure 2. Average post-assessment CER scores for student groups. Group 1 ($n=13$) used WIS & WIM statements in CER. Group 2 ($n=11$) did not.

Impact on Student Confidence in Writing Explanations

- Survey results showed students felt more confident in ability to write claim, evidence, and reasoning in explanations but didn't attribute to I^2 strategy.
- Some confusion about what in summer school was part of I^2 strategy. When asked what else helped improve evidence and reasoning, some said, "the what I see and what it means statements" and "what we did with the graphs."

Conclusions

- Subset of data shows I^2 strategy is effective at improving students' use of evidence & reasoning in CER writing when they write relevant WIS & WIM statements.
- Data suggests I^2 strategy can be made more effective by adding instructional practices, such as reading & evaluating text on science concept observed in lab data and using class discussion & questioning techniques to improve relevance of WIS & WIM statements students write.
- Adding graphing scaffolds when first using I^2 strategy would also likely improve relevance of WIS & WIM statements, as students who had inaccurate graphs typically wrote irrelevant/inaccurate statements.
- Investing time to improve the quality of WIS & WIM statements students write would help improve students' ability to analyze and interpret data, and thereby likely improve evidence and reasoning used in their explanations.

Implications to Work

The subset of data supports continued use of the I^2 strategy with students as it can be effective at improving evidence and reasoning scores in CER writing. As a district Science TOSA, I will share knowledge from the study and coach teachers in additional instructional strategies shared above, likely leading to district-wide improvement of students' ability to analyze data and write explanations with relevant evidence and reasoning.