



Background

- Creation of Next Generation Science Standards (NGSS) in 2013, led to Minnesota adoption of new NGSS influenced science standards by 2023-2024 school year.
- This led to adopting a three-year (2019-2021) middle school integrated curriculum intertwined with the new Minnesota science standards.
- During our pilot we found a disconnect between our phenomena-based curriculum, disciplinary core ideas, science and engineering practices, and crosscutting concepts
- Our research lead us to Storylines. Storylines provide “a coherent sequence of lessons, in which each step is driven by student’s questions that arise from their interactions with phenomena” (Edwards et al., n.d.).

Treatment

- This research took place within the 2020-2021 school year, which presented unique circumstances due to the COVID-19 pandemic.
- During the time of data collection, Caledonia Public Schools was using a hybrid learning plan for 6th & 7th grade which placed students in the classroom once a week, and online once a week, thus required longer time for data collection. A small portion of the data collection also took place during distance learning at home.
- The two sections of 6th grade started with a nontreatment unit and switched to a treatment unit. The two sections of 7th grade alternated between opposite treatment and non-treatment units
- The treatment consisted of implanting a storyline to lead the direction of the unit. Each treatment unit consisted of a Driving Question Board (DQB) in which students formed questions after being exposed to a phenomenon.
- The nontreatment consisted of a traditional teacher-led unit in which students were unaware the direction in which the unit was moving.

Focus Question

Can storylines create an inherent connection between anchor phenomena and three-dimensional instruction within an integrated science classroom?

Data Collection Methods

Figure 1: Data Collection Methods chosen based on sub-focus questions derived from the focus question.

Sub-Focus Questions	DCI Unit Test	SEP Performance Assessment	SEP & CCC Student Survey	SEP & CCC Written Survey	Misconception Probes
Can storylines connect the phenomena to disciplinary core ideas to produce more authentic learning?	X	X	X	X	X
Can storylines help students learn to use science and engineering practices by investigating phenomena?	X	X	X	X	
Can storylines help students develop a deeper understanding by making connections based on crosscutting concepts?			X	X	X

SEP & CCC Student Survey

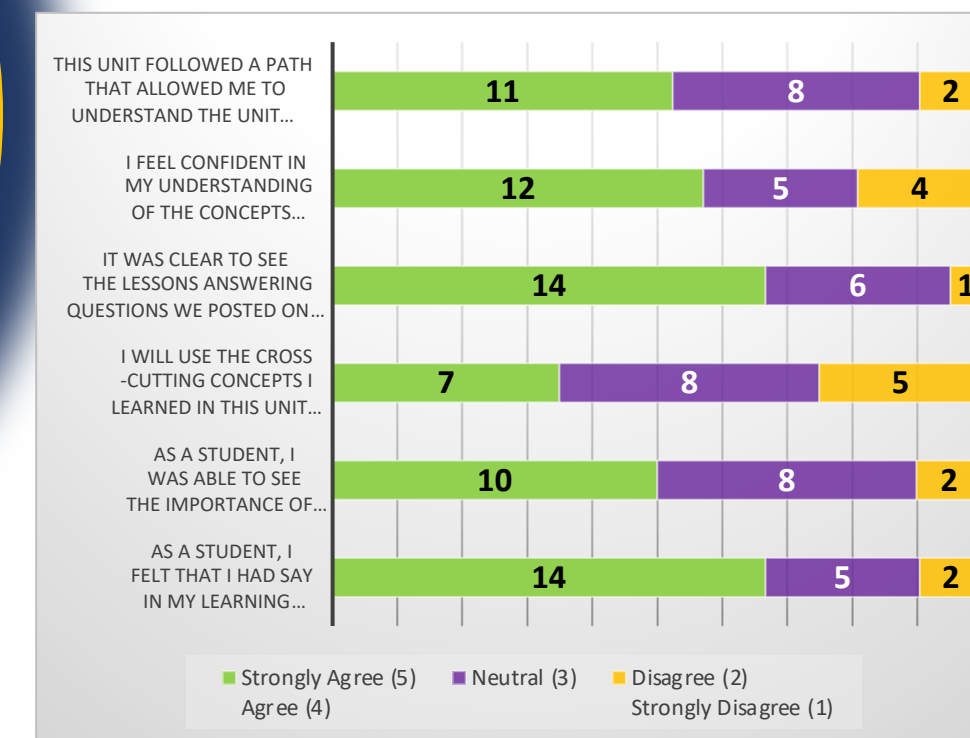


Figure 7. Likert Survey Data from Reproduction SEP & CCC Student Survey, Section 1 Nontreatment (N=21). This section of the survey was based on “Science and Engineering Practices and Crosscutting Concepts” statements.

- The trend of slightly higher rating in the SEP & CCC Student Survey were consistent among all four data collection units.
- “I felt like I was in the shoes of the teacher”
- “I was able to see what other students were thinking. Some students thought like I did and others were thinking differently about the same topic.”

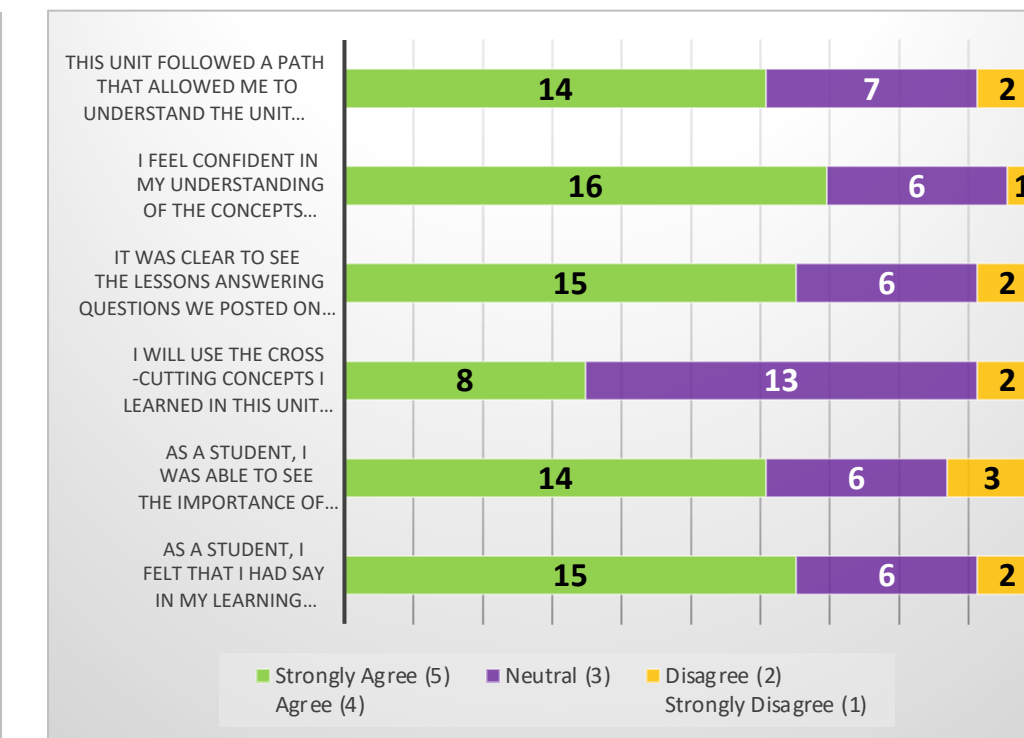


Figure 8. Likert Survey Data from Reproduction SEP & CCC Student Survey, Section 2 Treatment (N=23). This section of the survey was based on “Science and Engineering Practices and Crosscutting Concepts” statements.

“Mrs. Burmester with all do respect, why do we need to know this?”

DCI Unit Tests

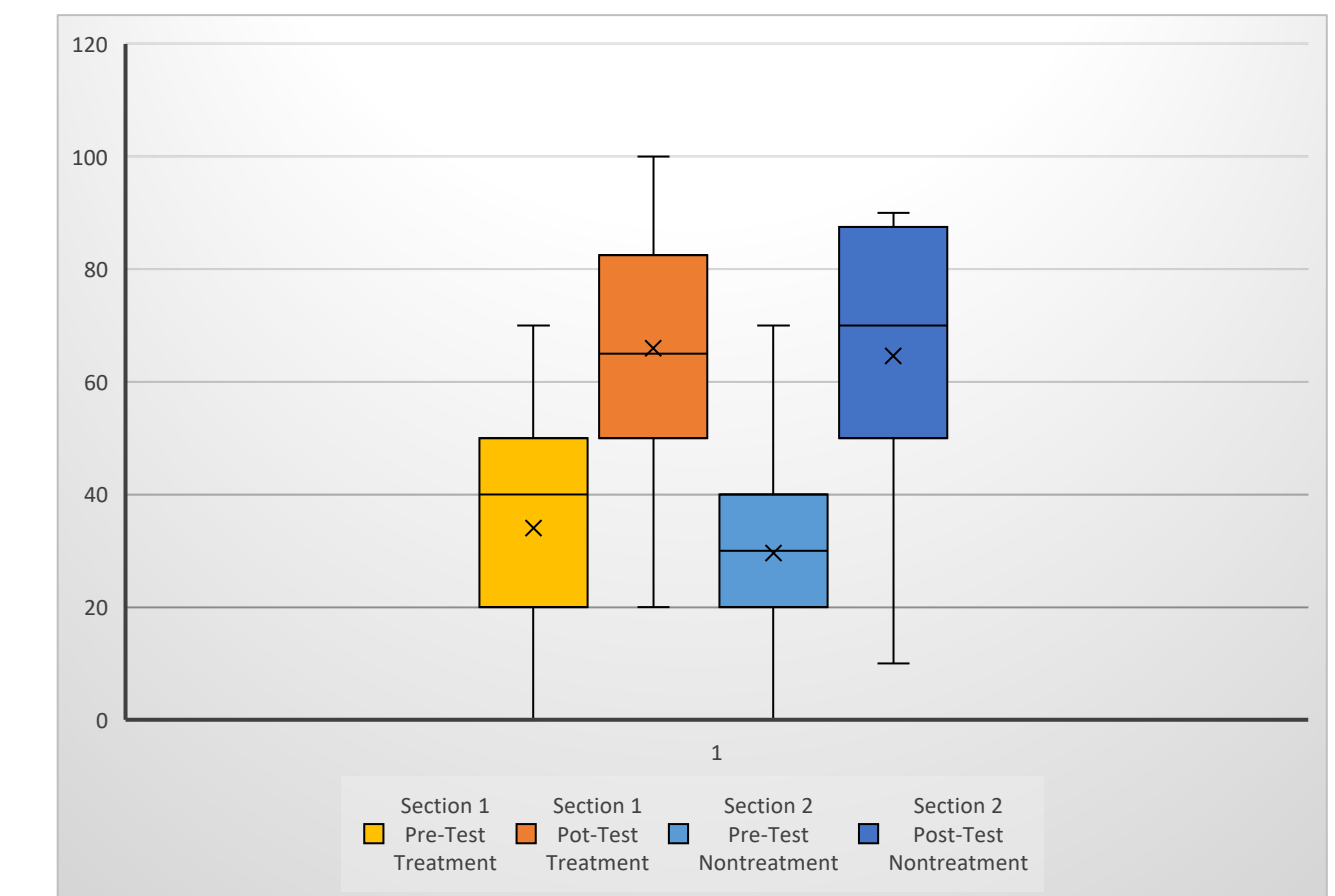


Figure 3. A box plot for the 7th grade Food and Energy Pre- Post- DCI Unit Test (N=45) Section 1: Treatment (n=22), Section 2: Nontreatment (n=23).

- Data provided from DCI Unit Tests show mixed results for all four DCI Unit Tests including the Food and Energy DCI Unit Test above.
- The Food and Energy DCI Unit Test treatment groups showed a lower point increase from pre- to post-tests in the treatment versus nontreatment group.
- However, the average normalized gains for the Food and Energy DCI Unit Test treatment group was 0.33 indication medium gain compared to the Food and Energy DCI Unit Test nontreatment group which was 0.27 indication a low gain (Hake, 1998).
- The 6th grade Section 1 showed an average normalized gain of 0.66 for the treatment unit (medium gain) and an average normalized score of 0.74 for the nontreatment unit (high gain).
- The 6th grade Section 1 showed an average normalized gain of 0.63 for the treatment unit (medium gain) compared to 0.59 calculated for the nontreatment (medium gain).
- However, when the average normalized gains were calculated for the full sample size the average normalized gains were similar with 0.65 for the treatment unit compared to 0.67 for the nontreatment unit

Claim, Evidence, Reasoning

- Claim 1:** Storylines connect the phenomena to DCI for more authentic learning: No evidence present in DCI Unit Tests, but some evidence in SEP & CCC Student Survey. SEP & CCC Written Survey also provided evidence for this claim with student quotes such as, “It helped me get more into the unit because it answered things I wanted to know.”
- Claim 2:** Storylines help students learn SEP by investigating phenomena: Quantitative evidence collected was inconclusive. SEP & CCC Written Survey provided slight evidence with quotes such as, “I learned that we are actually surrounded by models and use them everyday.”
- Claim 3:** Storylines help students with deeper understanding of CCC: No quantitative evidence was found to support this claim. Some qualitative evidence was provided by the SEP & CCC Written Survey with student answers such as, “Finding patterns in data is something that I will use in high school.”

Action Research Impact

- Future editing of assessment techniques for 3-D alignment
- Growth in content knowledge
- Greater ability to modify and develop lesson fluidly
- Greater emphasis on CCC within classroom