BACKGROUND

- This study was conducted in eighth grade integrated science classes at Twin Falls Middle School in North Bend, Washington. One of the school’s key principles is that students learn best through engagement and collaboration, which fits in well with the adoption of the Next Generation Science Standards (NGSS) that ask students to develop the skills and practices of scientists.
- The NGSS framework also emphasizes that student thinking and conceptual development change and progress over time (NRC, 2007). Topics are explored again and developed at a more sophisticated level at later grades.
- NGSS authors recommend opportunities for self-reflection through formative assessment. (NRC, 2014). Formative assessment makes student thinking visible, and provides a path to changes in instruction (Dozier, 2015). Angelo and Cross (1993) note that the focus of formative assessment is to improve student learning, not teaching practices.
- These principles, and the adoption of the NGSS by Washington state, prompted a deeper level of exploration on my part: to guide rather than direct students and to encourage students to adopt practices and develop skills that scientists use in the real world. A first step is for students to develop a familiarity with the vocabulary surrounding the science practices and concepts.

FORMATIVE ASSESSMENT

Students complete four claim evidence reason paragraphs (CER) for each type of assessment. Establishing a standard rubric for scoring was essential. Rubic scores correlate (r=0.73) with student achievement and are a reflection of the students’ understanding of the science practices and concepts. One of the key principles at the school is to watch videos, a breaking activity, sorting, tug of war, and poster introductions.

FOCUS QUESTIONS

Focus Question:
- How does using the 3 Dimensions (3D’s) of the NGSS in formative assessment impact a middle school science classroom?

Sub-questions:
- How does instruction and familiarity with the 3D’s impact students' use of science and engineering practice (SEP) and crossing concept (CC) vocabulary?
- Does knowing the 3D’s make a difference in student achievement?
- Are students more comfortable with one dimension of NGSS than others?

METHODS

- This study started and ended with a survey of scientific thinking skills to measure changes in students’ ability to reason.
- At the start of treatment, students participated in activities to familiarize themselves with the 3D’s of NGSS: watching videos, a code-breaking activity, sorting, tug-of-war, and poster introductions.
- During treatment period, students were given content based formative assessments that also included questions about use of the crosscutting concepts and the science and engineering practices of the NGSS.
- Students completed four claim-evidence-reasoning pre-treatment assessments before, during, and after the treatment period.

RESULTS

- Students completed four claim-evidence-reasoning pre-treatment assessments before, during, and after the treatment period.
- Are students more comfortable with one dimension of NGSS than others?

CONCLUSIONS

At the end of the treatment period students:
- Were able to use a wider variety of crosscutting concepts to describe their learning process.
- Were able to incorporate a greater number of crosscutting concepts and science and engineering practices in their writing.
- Did not significantly change their academic achievement levels.

REFERENCES


Student Quotes

“It allowed me to connect things/ideas and understand them more completely.”

“I feel that I not only understand the concepts better, but I can apply them to my pre-existing knowledge to make scientific claims that are as strong as possible.”

“Something that I feel that I not only understand the concepts better, but I can apply them to my pre-existing knowledge to make scientific claims that are as strong as possible.”