THE EFFECT OF MODEL-BASED INQUIRY TEACHING ON STUDENT ENGAGEMENT, AND THE NGSS SCIENCE PRACTICES IN HIGH SCHOOL BIOLOGY

Brennan Van Loo

Sedro-Woolley High School, Sedro-Woolley, WA 2016-2017

Background

Throughout my teaching career I have had roughly 20% of my students who lacked the engagement and motivation necessary to be successful in Biology. I have tried various strategies, such as interactive notebooks, without success for this sub-group of students. Despite my various efforts these students have remained unengaged, and stay content with grades of D's to C's even though these students are capable of much better work.

The purpose of my study is to investigate how model-based inquiry teaching, using the Ambitious Science Teaching (AST) framework, increases student motivation and engagement. I also hope to determine how this framework improves student skills with the Next Generation Science Standards (NGSS) science practices.

The Model Based Inquiry/AST approach that I will be testing is based on framing a unit of study with an anchoring event/puzzling phenomenon. Through the course of the unit students are engaged in various activities that help them solve or explain the event. One of the Ecology units I taught is about the Southern Resident Orca population in Puget Sound, and why the population hasn't grown despite a decade on the endangered species list. The activities of AST focus on student discourse, constructing explanations and refining models. I hope that this will lead to increased student interest in science for all students as well a desire to deeply understand a phenomena and the scientific concepts behind it.

Questions

Main Question

How will the Ambitious Science Teaching (AST) framework of using a puzzling scientific phenomena and evidence based explanations to frame a unit of study increase student motivation and engagement in biology?

Sub-question #1

In what ways will students' discourse skills improve?

Sub-question #2

How will students' ability to provide evidence and reasoning for their ideas change?

Sub-question #3

How will teacher perception of AST and science teaching change?

Instruments

- Student Survey on Motivation and Engagement
- Observation and tracking of on-task behaviors
- Peer-Evaluation of discussion participation
- Evaluation of student work with Claim, Evidence, Reasoning Rubric
- Teacher notes and reflections on using Ambitious Science Teaching

Treatment

For my treatment I taught all of my units using the framework and vision of Ambitious Science Teaching which is described below.

The Vision of Ambitious Science Teaching

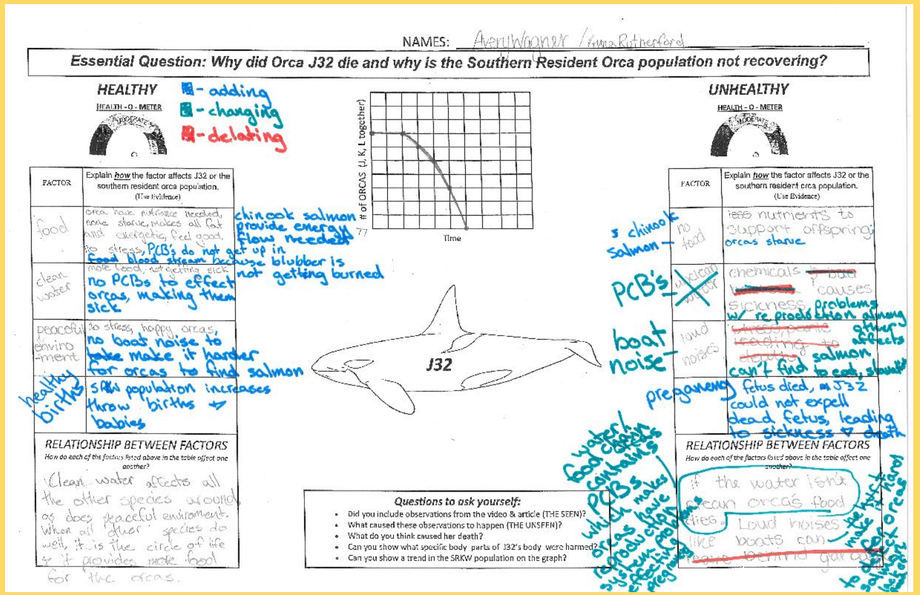
The ambitious teacher is someone who "works with students' ideas" over time. What would you experience in classrooms where ambitious teaching was the focus? You would see and hear:

- Teachers anchoring their instruction in complex and puzzling natural events
- Students engaging in multiple rounds of creating and revising scientific models, explanations and evidence-based arguments
- Teachers using a variety of discourse strategies with students to get them to think deeply and to respond to each other's thinking
- Students prompting each other to engage in sense-making talk during investigations and other activities
- Students' ideas being represented publicly and worked on by the class
- Teachers using specialized tools and routines to support students who are not willing or able to participate without help
- Students speaking up about what information or experiences they need to move their thinking forward

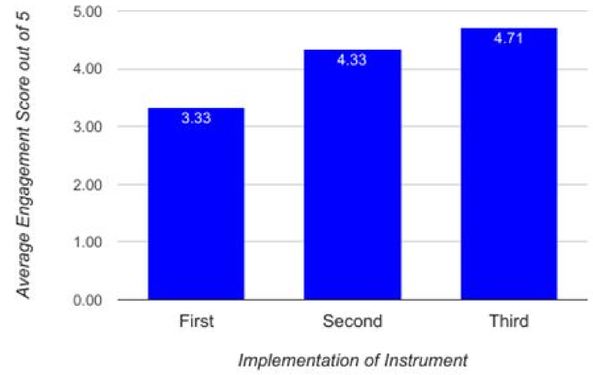
(http://ambitiousscienceteaching.org/)

Student Work

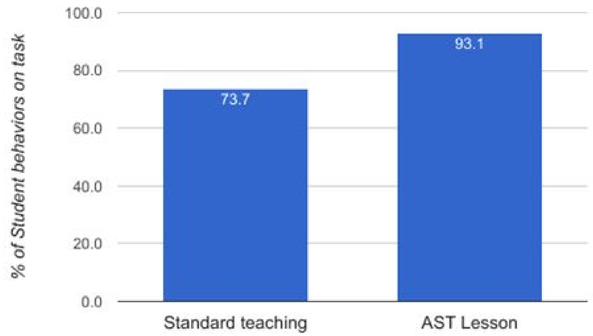
This Model Scaffold from the first Ambitious Science Teaching unit shows students initial ideas, and how they have revised their model over time



Data



Peer Observation of Discourse Instrument. Average engagement score, (*N*=24)



At-Task Observation Instrument. Percentage of on task behaviors (*N*=89)

Conclusions

The results show that the treatment promoted engagement and that students skills in discourse and argumentation increased. However, students perception of their motivation and engagement did not change with continued treatment. This study shows that model-based inquiry has significant value for students who have historic academic struggles as it moves science beyond the rote memorization that they struggle with, to explaining what is happening based on experimental and personal experience