The Effect of Personalized Feedback on the Ability of Students to Overcome Misconceptions in a Project-based Science Curriculum

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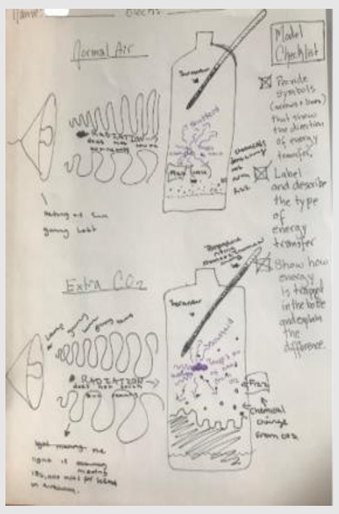
BACKGROUND

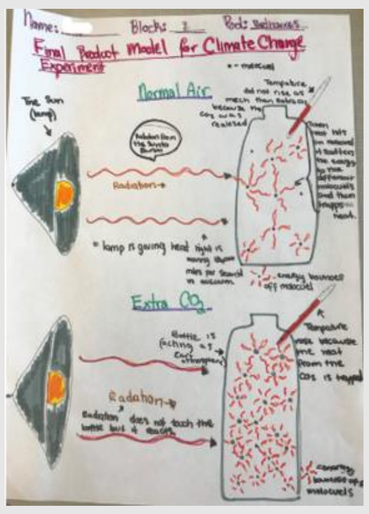
Students at Summit Atlas work with teachers through a project-based curriculum as well as independently with a self-paced content mastery curriculum through the student learning platform. Students demonstrate mastery of content by studying online resources and then passing a series of online quizzes. Persistent misconceptions about science concepts have been observed in student work even after students pass the online quizzes. In the project-based curriculum students work with teachers to learn and demonstrate proficiency in a set of cognitive skills they will need expertise in for college. A teacher's role in this system is to provide feedback on students' cognitive skills and to guide students towards mastery. Students have multiple opportunities to revise their work until passing and they rely on teacher feedback to move them up in levels of the cognitive skills. My research focused on assessing the impact of teacher feedback on misconceptions seen in student generated models of phenomena on student's ability to overcome misconceptions.

METHODOLOGY

- All students participated in the pre and post survey's for content knowledge and perceived usefulness of feedback.
- Students drew models of the Climate change in a bottle experiment and attempted to explain the processes of thermal energy transfer and extra heat being trapped by carbon dioxide compared to regular air.
- Student models were evaluated for naïve conceptions and unique misconceptions.
- TREATMENT – students were given either detailed feedback with explanation and example (group A) or brief feedback (group B).
- Out of the 85 students who participated in the study 22 had unique misconceptions that were evaluated for the treatment.
- Students were interviewed about their use of teacher feedback for the



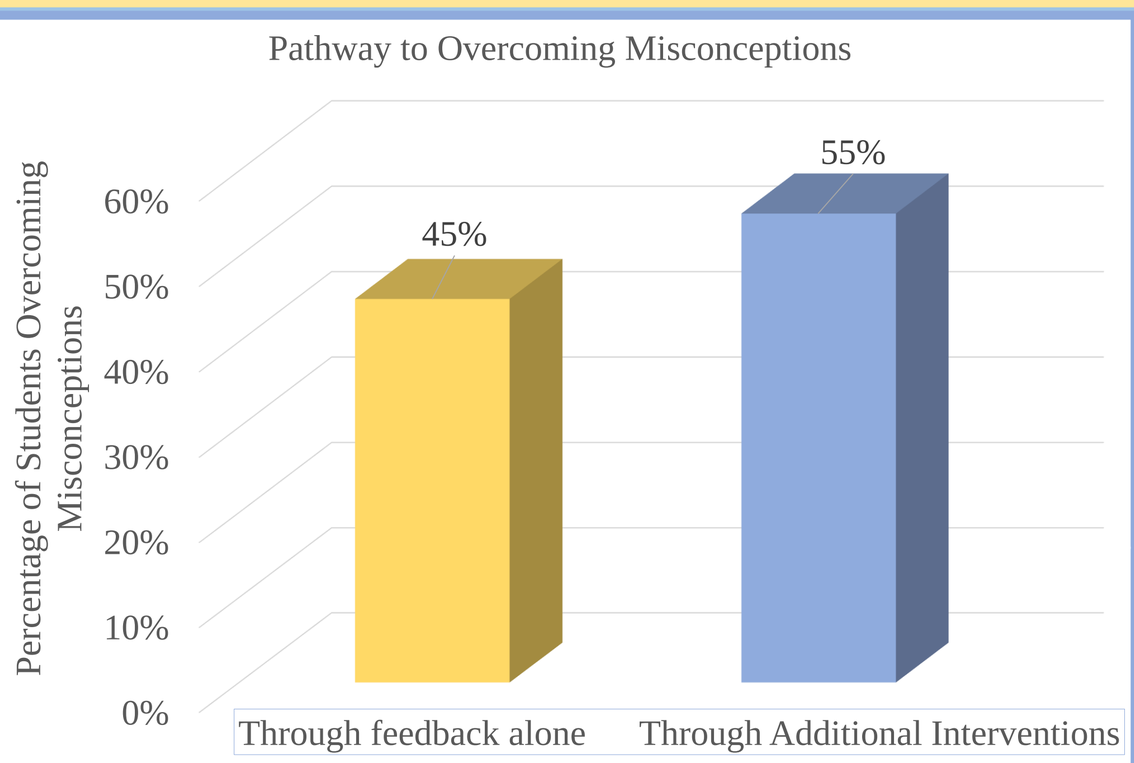
FEEDBACK



DATA TRIANGULATION MATRIX

Focus Questions	Data Source 1	Data Source 2	Data Source 3
Primary Question: How does personalized teacher feedback target student understanding of science concepts and does it a student's ability to overcome misconceptions in a project-based curriculum?	Pre and Post project survey of content knowledge	Comparison of Draft and Final Product models	Student Interviews
Sub Question 1: What misconceptions or naïve conceptions do middle school students have about global climate change and thermal energy transfer?	Survey of content knowledge	Draft Models	Student Interviews
Sub Question 2: To what extent do students utilize teacher feedback to improve their cognitive skill scores and revise their content understanding?	Pre and Post project surveys about feedback	Tracking for misconceptions that are overcome immediately in final models after feedback or that need additional interventions.	Students Interviews with about the feedback process.

DATA ANALYSIS

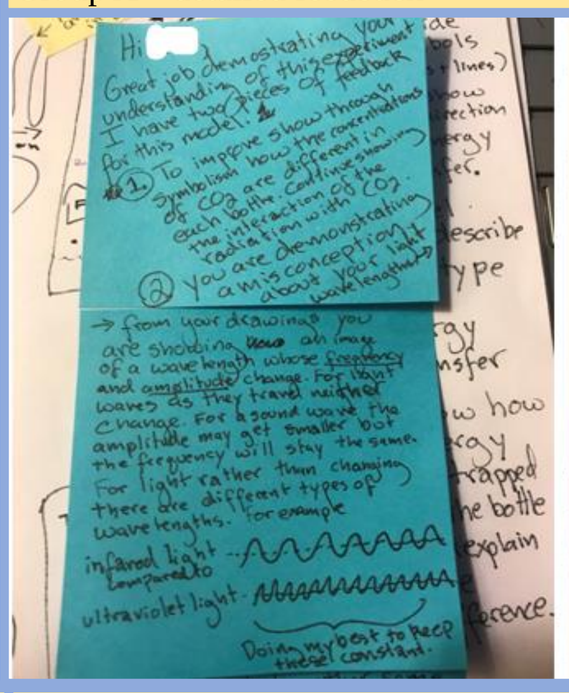


- The amount of detail in the personalized feedback did not significantly affect students' ability to overcome their misconceptions.
- In a comparison of students in group A, given detailed feedback, and group B, given brief feedback, there was a not a significant difference in overcoming misconceptions through feedback (p-value 0.70 chi-square test).
- Personalized student feedback positively impacted students' ability to overcome misconceptions
- 45% of students overcame their misconceptions through the process of personalized feedback (*N=22*).
- The change can be directly attributed to the feedback process, as final project drafts were created during class directly after feedback was handed back, with students working on their models independently.

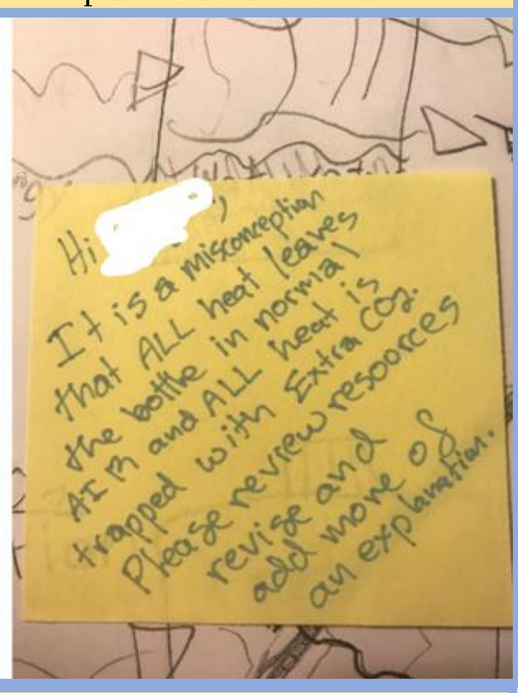
Student interview response to what was useful in improving their work and understanding about thermal energy transfer:

"Definitely the feedback because the feedback told me what to fix. I understood the feedback and put it into this model."

Group A – detailed feedback



Group B – brief feedback



CONCLUSIONS

Feedback is helpful to students who demonstrate misconceptions. Personalized feedback was effective for 45% of students, helping them overcome misconceptions demonstrated their models.

The type of feedback given did not matter. There was no significant difference between providing detailed or brief feedback in helping students overcome misconceptions.

Observation that many student misconceptions were unique and specific.

VALUE

- Improved practices to organize my feedback and support for students
- Increased consistency in the way that I give feedback
- Creating processes for identifying student misconceptions in models and categorizing them to help plan targeted interventions
- Development of mastery badging incentive for students to demonstrate content understanding in projects
- Integration of small group instruction and one-on-one teacher conferences

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