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The Odd One Out: Model-Based Biology in ESL Classrooms

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Mai, Cat; Hassan, Anisha; and Chiem, Tina, "The Odd One Out: Model-Based Biology in ESL Classrooms" (2019). *Academic Spree Day and Fall Fest*. 18. https://commons.clarku.edu/asdff/FF2019/posters/18

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Next Generation Science Exemplar (NGSX) is an innovative professional development program designed to support K-12 educators across the U.S. as they make the shift in teaching to accommodate new science education standards. These standards are called for by the National Research Council's Framework for K-12 Science Education, referred to as a shift from "learning about" and the Next Generation Science Education and the Next Generation Science Standards (NGSS). science to "figuring out" science. Students are positioned as scientists themselves, in curricula designed to empower students of all backgrounds. Thus, the Framework and NGSS put forth a vision of more equitable science education, and we at NGSX hope to support teachers in making these changes through workshops and our website platform. NGSX is also a research site for learning about teachers' professional development, teacher education, and science education more generally. We look at things like whether and how teachers see their students and their classrooms, to see how they lead their classes through NGSS-aligned curricula. We conduct interviews and analyze discussions in order to improve our own practice, as well as to reflect on the current state of science education in the U.S. For more information on NGSX, please see our website, www.ngsx.org.

Model-Based Biology (MBER-Biology) is a full-year high school biology curriculum developed by a team at the University of California, Davis led by Dr. Cindy Passmore and funded by NSF. It is the first full-year biology curriculum designed to align with the Framework and NGSS. MBER is designed for equity and access and is a discussion-based curriculum. It supports students in developing a set of explanatory models in the life sciences that can be used to explain a range of phenomena answering the big question about why there is both some much unity as well as diversity across living things. In each unit, phenomena motivate student questions and the class works together to build explanatory models that can be used to answer their questions and generalize to other phenomena and challenges relating to life and our environment. The objective of MBER is to shift the dynamics in classic test-driven and critical thinking-oriented where the students can take charge of their own learning.





Discussion about what it takes to shift from "school as usual" to "figuring out"

"Odd One Out": Model Based Biology in an ESL Classroom

Tina Chiem '20, Cat Mai '22, Anisha Hassan '21 Education Department – Advisor: Sarah Michaels, PhD

WHAT IS NGSX AND MBER?

NGSX LEARNING LAB AT CLARK AND OUR WORK

In the Learning Lab at Clark, our job is to support NGSX. Sometimes this means helping on the research side of things—transcribing interviews or discussions, preliminary data analysis, and so on. In the fall of 2019, our main goal is to help NGSX develop a new "pathway" (read: workshop) for high school teachers at the Worcester Public School classrooms where MBER - Biology is being implemented for the year.

In doing ethnographic work, we do our best as a team to be participants in the classroom. We model discussion norms and what the students are supposed to be doing. We act sort of like older siblings, where we never redirect the teachers' flow, but we have the unique opportunity to reach students on a "kid-to-kid" level. We document their progress through the units by videotaping, and in the future, plan to use these logs to create a video case, showing important '*Magic Moments*' (what is possible) and *Hinge Moments*-where core concepts in the unit are discussed by the class, and concepts formed throughout the unit are solidified—to other educators looking to learn how to facilitate the MBER curriculum and productive talk.

Our team is in the process of collecting a set of video cases ('*Magic Moments*') so we can showcase the progress the students have made through MBER and how the teachers use this curriculum to promote collaborative thinking, agency, and robust learning of biology. Our research focus is how the building of classroom culture works and how that affects students' participation, agency, and learning. As both designers and researchers, we are committed to understanding how this new vision of teaching and learning science is possible with students from a wide range of linguistic and cultural backgrounds, including English Learners and students who have struggled in the past.

Context and Challenges:

The classroom we observe has a co-teaching model with two teachers, one of them being an ESL teacher. All students at both sites are ELL (English Language Learning) students. Many are recent arrivals to the U.S., and they come with a wide variety of prior science and biology education. On top of that, the teachers have been preparing this extreme diverse set of students to pass the MA high-stakes MCAS biology test. Furthermore, part of why we're so interested in these sites is that this is one of the first times that we're trying out MBER in classrooms where students don't all speak the same language. This is a challenge for teachers to facilitate, because MBER emphasizes class discussion and

MBER-Biology as an Epistemic Tool

MBER-Biology, just like many others, is an epistemic tool. We want to discuss its role in disrupting "epistemic injustice," the loss of intellectual courage, the belief that one's ideas are important, and the hope that one's voice is heard and valued by people with power. [1] Students' recognition and use of epistemic agency aim to disrupt a common occurrence in classrooms —the denial of knowledge production opportunities to certain individuals and communities, and the silencing of their voices by marginalizing them from public discussion. [2] To help the process of teachers building classroom culture, we are introducing the concept of "talk moves" as tools to producting productive talk. Talk moves are "strategic teacher moves designed to open up the conversation and support student participation, explication, and reasoning." [3] To quote Dr. Passmore, "In order to be fully engaged in the practices, it's simply not enough to merely learn about the science idea [..]. To engage in the practices, really participate in them, a student has to frame the task as an exploration."[4] We believe deeply in every student's ability to participate in this kind of difficult, student-driven scientific education—but we also acknowledge that not everyone shares that view. Our mission, as we continue our ethnographic research, is to help teachers recognize what their students can do and guide them in leading their students through rich learning opportunities—for the sake of equity and empowerment for all.







Period 1 students at South High