

Project RIEL: Responsive Instruction for Emergent Bilingual Learners in Biology Classrooms

Overview:

This Early Stage Design and Development Study in the Learning Strand builds from our team's previous work to create an innovative biology learning approach that integrates culturally and linguistically responsive instruction with Next Generation Science Standards-driven experiences for English learners (ELs) in two Florida school districts. Responsive Instruction for Emergent Bilingual Learners in Biology Classrooms (RIEL) is a partnership among the University of Florida's Science Education, Bilingual Education, and Biology faculty; University of South Florida's Science Education faculty; and Alachua and Hillsborough County Public Schools.

RIEL seeks to transform science learning experiences for ELs by leveraging linguistically and culturally responsive instruction to engage students in NGSS Science and Engineering Practices. Despite the rich linguistic, cultural, and academic resources that ELs bring to classrooms, they continue to struggle in secondary science classrooms; approximately 73% of ELs in Hillsborough County and 58% of ELs in Alachua County received scores of Inadequate or Below Satisfactory on the state's Biology End of Course exam in 2018. Nationally, ELs are underrepresented in advanced secondary science courses, and Hispanic/Latinx communities—the largest sub-group of ELs—are underrepresented in STEM professions. RIEL addresses these issues by targeting EL participation in high school biology, a foundational course in students' STEM trajectories.

This project will use design-based research principles to empirically refine a model of culturally and linguistically responsive pedagogy. This model—the RIEL framework—includes six robust practices that support EL engagement in Science and Engineering Practices by building their content and language knowledge simultaneously. Over the project's three-year span, we will (1) refine this model through multiple iterations, (2) examine which aspects of the model support EL achievement and participation, and (3) examine how more than 30 teachers implement the model in their classrooms.

Intellectual Merit:

RIEL builds on the current research base and our own pilot work with ELs in biology classrooms. This research suggests that ELs need opportunities to engage in disciplinary practices, and that language and content knowledge support this engagement. At the same time, engaging in practices creates opportunities for ELs to further develop new language and content understandings. Our previous work shows that ELs also need opportunities to collaborate, to use home languages, and to feel like important members of their classroom communities. RIEL is innovative in that it draws from existing models of STEM education for ELs and merges these approaches with culturally responsive instruction. Our team is distinctly positioned to undertake this work and disseminate findings to teachers and researchers. Brown brings expertise in culturally responsive science education and design-based research; Pacheco in responsive education for ELs; Jung in academic language in science classrooms; and Davis as a disciplinary expert in biology. Few NSF-funded projects directly examine secondary EL learning, and moreover, few research teams have combined STEM and EL expertise.

Broader Impacts:

RIEL is positioned to make three important contributions. First, in alignment with the Learning Strand's goal of supporting underserved learners, RIEL targets EL participation in biology classrooms with the goal of improving EL achievement and broadening EL participation in STEM fields. We will work with nearly 3,500 students over the course of the project, and will prepare more than 30 biology teachers to extend the impact of our work in years to come. A project website will house a database of NGSS-aligned RIEL biology lessons and assessments, all teacher-created tools for RIEL instructional planning, PD activities, and the RIEL framework. Second, in alignment with the Learning Strand's goal of improving instruction through innovation, RIEL extends current best practices, and will serve as an empirically-grounded model of culturally and linguistically responsive instruction for a growing EL population . Lastly, in alignment with the Learning Strand's goal of transforming teaching and learning, RIEL contributes to research that documents how EL strengths and prior experiences inform their academic success. RIEL builds on the strengths that students and teachers bring to the classroom to make instruction more equitable, rigorous, and meaningful.