Leveraging the Cultural Practices of Science for Making Classroom Discourse Accessible to Emerging Bilingual Students

Problem

In current elementary science classrooms, students who are learning English as a second language are often excluded from activities. The primary reason is because learning environments are predominantly designed to accommodate English as the sole language of communication and instruction. The trend is expected to worsen, as more of these students are expected to enter schools and the increasing scarcity of qualified teachers who can meet students' language needs (Kindler, 2002). While this group of students is regularly referred to as English Language Learners (ELLs), we will use the term emerging bilingual to highlight the range of resources they bring to the classroom (Escamilla and Hopewell, 2010).

Literature shows that there has been a significant decrease in the amount of classroom time devoted to science in elementary schools, partly because of pressures to increase emerging bilingual students' English fluency (e.g., McMurrer, 2008). And, as mentioned above, elementary school teachers struggle to create learning environments in which emerging bilinguals can engage and participate in science activities. We believe, on the contrary, that science is the perfect context for providing opportunities for students to use language as a tool for communicating, which promotes students' language development. A learning environment centered on scientific practices, which capitalizes on students' natural curiosity and desire to understand the world, then, can support emerging bilingual students to engage in discussions with peers about meaningful questions.

Despite valuable efforts to understand the role language plays when emerging bilingual students learn science (Rosebery, Ogonowski, DiSchino, & Warren, 2010; Suárez and Otero, 2013; Suárez and Otero, in press; Warren, Ballenger, Ogonowski, Rosebery, & Hudicourt-Barnes, 2001; Warren, Ogonowski, Pothier, 2005), it is still not yet clear how to increase the participation of emerging bilingual students in science classroom activities. This study, then, would explore the hypothesis that science, physics in particular, is especially well-suited for increasing the participation of emerging bilingual students in negotiating meaning and participating in class. The results from this study would contribute to the literature on science education, specifically with regards to designing learning environments that engage emerging bilingual students. Additionally, it would contribute to the literature on English language development, particularly in identifying effective learning environments that foster participation and discussion. Lastly, this work would have pedagogical implications for how elementary school teachers can make their science lessons more accessible and inclusive.

Theoretical Background and Literature Review

Researchers have proposed Productive Disciplinary Engagement (Engle & Conant, 2002) as a construct for describing active student participation. Specifically, this type of engagement is defined as one in which students spontaneously participate, substantially contribute, and attend to each others' ideas in a way that resembles disciplinary discourse practices and furthers intellectual progress. While not proposed with emerging bilingual students in mind, this framework can help us understand the learning environment features that can increase these students' engagement and participation. Four measures have been suggested to evaluate if a learning environment can foster this type of engagement. First, teachers should encourage students to problematize the content through questions, proposals, and challenges. Second

important for Òstudents to be authors and producers of knowledge É rather than mere consumersÓ (Engle & Conant, 2002; p. 404). Third, students should be held accountable, particularly by how their work is responsive to what community insiders and outsiders have established. Finally, it is necessary for students to have relevant intellectual and/or material resources to aide sense-making (Engle & Conant, 2002). While this is not the only framework that describes disciplinary engagement, we chose it because of how well the four principles align with disciplinary practice, especially authorship and accountability to the local and disciplinary communities. Based on these four principles, we propose that physics has a clear advantage over other subjects because experimentation typically involves the presence of tangible objects and shared observations. Moreover, scientific practices involve supporting and promoting student participation through reasoning, argumentation, and sharing ideas about observations of phenomena, all of which can be accessible to students with different levels of English fluency.

We see almost a one-to-one correspondence between the four principles proposed by

We view learning as a social practice (Rogoff, 1994; Wenger, 1998) and as such students' development of conceptual understanding and language skills is constructed through social interactions. Our position on language differs significantly from second language acquisition models, which propose that language is an external device that needs to be acquired by the learner, instead of a meditational tool that is socially and iteratively constructed through interactions. This perspective is based on the work by Razfar and colleagues (Razfar, Khisty, Chval, 2010), who redefine "language as a mediational tool for learning rather than the object of learning and instruction" (p. 214). Razfar et al., (2010) prompt us to think about language development as concrete steps students take towards "the use of any word to signal a object in a decontextualized manner" (p. 201) and abstraction, which can only be achieved through situated understanding. This has significant implications for how teachers structure learning environments and activities for students to engage with. Particularly, the fundamental question for designing and organizing learning environments should be "how will students use language to reach the learning goals?", rather than "what language do we expect students to acquire?". Finally, this model positions students as capable of learners whose development depends on the participation on multiple types of learning activities.

We hypothesize that science is particularly suited for creating hybrid spaces that provide opportunities for emerging bilingual students to become the authors and evaluators of evidence based claims generated by shared, tangible experiences, furthering conceptual understanding. This study would address the following general question: what role do everyday and academic language play when emerging bilingual students engage in making sense of the physical world? Specifically: (i) what features of a classroom based on scientific induction foster productive disciplinary engagement of emerging bilingual students? and (ii) how do third spaces, where everyday and academic language interact, affect students' meaning making?

the model described below (see Implementation Design). In addition to the first requirement, they would need to teach any of the grades 1-5 and, as mentioned above, at least 50% of their students would need to be classified as emerging bilinguals. Ideally I will be able recruit two to three teachers from the same school, which would make comparison between classrooms easier given that they would all be embedded in a similar context. There will be no specific requirements for students to participate in this study, other than being in a classroom where a majority of students are learning English as a second language, and sign appropriate consent forms agreeing to participate in the study.

Implementation Design

This study relies on the framework of Productive Disciplinary Engagement for designing curricular units and activities, as well as exploring what features of the learning environment may support emerging bilingual students engaging in classroom science discourse. Any activity created or revised for the purpose of this study would have to meet the productive disciplinary engagement principles from Engle and Conant (2002): (i) provide opportunities for students to problematize content and observed phenomena; (ii) create spaces for students to author ideas; (iii) foster a culture of accountability to the local classroom community; and (iv) make available material and symbolic resources for students to use during making sense of phenomena. In other words, the resulting activities from the collaboration between teachers and I would have to have meaningful questions, tangible objects students can interact with, and create opportunities for students to share experiences about phenomena; an environment in which students feel safe offering their thinking and where everyday and academic language interact is also important.

I anticipate a certain amount of variation across the different classrooms and teachers I work with. This difference will be due to the range in experiences and goals of the participating teachers, difference in grade levels, and the student composition of those classrooms. To account for this variance, I will create profiles

a record for what the original activity plan was, in case it is modified during implementation. Recording reflection meetings will also be important to determine what decisions were made while implementing an activity, and how they served engagement. Lastly, the

Timeline

References

Carspecken, P. (1996). Stage Two: Preliminary Reconstructive Analysis. In Critical Ethnography In Educational Research (pp. 93-120). New York and London: Routledge, Publisher.

Committee on Conceptual Framework for the New K-12 Science Education Standards, N. (2012). A Framework for K-12 Science Education: Practices, Croscutting Concepts, and Core Ideas (pp. 320). Washington, DC

Engle, R. A., & Conant, F. R. (2002). Guiding principles for fostering productive disciplinary engagement: Explaining an emergent argument in a community of learners classroom. Cognition and Instruction, 20(4), 399-483.

Escamilla, K. & Hopewell, S. (2010). Transitions to biliteracy: Creating positive trajectories for emerging bilinguals in the United States. In J. Petrovic (ed.) International Perspectives on Bilingual Education: Policy, Practice and Controversy, Information Age Publishing, 69-94.

Gutierrez, K. D., Baquedano-Lo—pez, P., and Turner, M. G. (1997). Putting Language Back into Language Arts: When the Radical Middle Meets the Third Space. Language Arts, 74(5), 1997.

Kindler, 2002 A. L. Kindler. (2002). U.S Dept of Ed. OELA, Survey of the statesÕ limited English proficient students and available educational programs and services, 2000-2001

McMurrer, 2008 McMurrer, J. (2008). Instructional Time in Elementary Schools: A Closer Look at Changes for Specific Subjects (pp. 8). Washington, DC.

Otero, V. K., & Nathan, M. J. (2008). Preservice elementary teachers' views of their students' prior knowledge of science. Journal of Research in Science Teaching, 45(4), 497-523.

Rogoff, B. (1994). Developing understanding of the idea of communities of learners. Mind, culture, and activity, 1(4), 209-229.

Rosebery, A. S., Ogonowski, M., DiSchino, M., & Warren, B. (2010). ÒThe coat traps all your body heatÓ: Heterogeneity as Fundamental to Learning. The journal of the learning sciences, 19(3), 322-357.

Razfar, A., Lic—n Khisty, L., & Chval, K. (2011). Re-Mediating second language acquisition: A sociocultural perspective for language development. Mind, Culture, and Activity, 18(3), 195-215.

Russ, R. S., Scherr, R. E., Hammer, D., & Mikeska, J. (2008). Recognizing mechanistic reasoning in student scientific inquiry: A framework for discourse analysis developed from philosophy of science. Science Education, 92(3), 499-525.

Su‡rez, E., & Otero, V. (2013) ÒBecause it hibernates fasterÓ: 3rd grade English Language Learners making sense of sound. Physics Education Research Conference Proceedings, 206-210

Su‡rez, E., & Otero, V. (in press). Physics as a Mechanism for Including ELLs in Classroom Discourse. Physics Education Research Conference Proceedings 2013

Vygotsky, L. Thought and Language. MIT Press, Cambridge, 1962.

Warren, B., Ballenger, C., Ogonowski, M., Rosebery, A. S., & Hudicourt-Barnes, J. (2001). Rethinking diversity in learning science: The logic of everyday sense-making. Journal of research in science teaching, 38(5), 529-552.

Warren, B., Ogonowski, M., and Pothier, S. (2005). ÒEverydayÓ and ÒScientificÓ: Rethinking

Enrique Suarez
2989 Shady Hollow East
Boulder, CO 80304
(405) 6428983
enrique.suarez@colorado.edu

Education:

August 2012 – present: Doctoral student in Science Education at CU Boulder

August 2010 – May 2012: MS in Science Education, Tufts University

August 2008 – May 2010: Physics doctoral student at Carnegie Mellon University

August 2006 – December

Sciences (SAMS) for underserved students, Carnegie Mellon University