# "I Have an Opinion About Science I Think Part Is True and Part Is Not" Emergent Bilingual/Multilingual Adolescents 'Figuring' Science Learning Through Virtual Labs

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**Abstract:** Based on a year-long ethnographic research in two eighth-grade science classrooms, with 25 Latinx emergent bilinguals, the study examines the affordances/limitations of virtual labs as mediators of science learning. Employing sociocultural theories and ontological views of learning, we explore students' learning of science with virtual labs and their evolving epistemic, conceptual, and identity trajectories with disciplinary knowledge and practices as enacted in formal-learning settings.

## Introduction

Drawing on a year-long ethnographic study in two eighth-grade science classrooms with 25 Latinx emergent bilingual students (otherwise identified as English Learners (ELs) by school districts), we examine the ways in which efforts to incorporate digital technologies (e.g., software and hardware) into the domain of science education affords and/or limits various possibilities for science meaning-making for diverse learners.

## Conceptual framework

We employ sociocultural theories and ontological views of learning (Lave & Wenger, 1991; Nasir & Hand, 2006; Wortham, 2006) to explore how availability of digital technologies might influence the context for learning science in formal-learning settings, potentially impacting students' evolving epistemic, conceptual, and identity trajectories with disciplinary knowledge and practices enacted and "figured" in traditional science classrooms. Specifically, we draw upon Holland et al.'s (1998) notion of "figured worlds" as frames of meaning constituted in cultural activities of formal-learning settings, into which learners enter with their personal, social, and epistemic histories. To this end, we examine the emergence of students' science figured worlds, heterogeneous and (often) tacit epistemologies learners draw upon (Sandoval, 2005), as they conceptually and performatively construct new meanings, understandings, and identity trajectories (subjectivities) in the context of technology- mediated science learning.

## Methods: Data collection and analysis

Data collection was based on ethnographic methods such as participant observations, field notes, structured and semi-structured interviews, personal and group dialogues with students, audio-recordings of classroom events, extensive artifact and document collections in two eighth-grade science classrooms during one academic year. In the first phase, the classroom data, i.e., observations, field-notes, audio and images related to students' engagement with digital technology, specifically "virtual labs," was analyzed inductively, using both categorizing and connecting approaches (Maxwell & Miller, 2008). To check our biases and presumptions as researchers, during the ensuing phase, we invited focal groups of Latinx students as critical research-partners (each focus group had between 3-5 participants at a time, with total of 5 groups) to participate with us in the second stage of systematic data analysis (Delgado-Gaitan, 1993).

## Findings

When we presented the data to our critical research partners, Latinx students in all groups challenged some of our initial findings/interpretations and provided us with "countering voices," see Table 1: Technology in the Figured World of Technology-Mediated Classroom Science.

Table 1: Table 1: Technology in the Figured World of Technology-Mediated Classroom Science

| **Students said…** | **We learned…** |
|---|---|

 

| | |
|---|---|
| "On the computer, it takes 3 seconds for water to boil, in reality it takes about 10 minutes. Most of us do not believe most of the science, why would we believe it? Not everything that you can do or see virtually is real in life, you know, some of it is an imagination." (Alejandro -Group (G.) A)<br><br>"Our teachers say that science is about discovery. Doing hands on labs would help a lot more because like – it's better to prove in many ways. I always believed it – I don't think those things will really happen. Our friends also say that they don't believe in science." (Maria -G. C) | While we, as educators and researchers, appreciate the affordances of virtual labs to provide interaction with scientific phenomena which occur at unobservable spatial and temporal scales, students do not share this value. Students saw the virtual labs as not representative of social phenomena constituted in the experienced, lived-in world, through legitimate peripheral participation in ongoing social and hands-on practice (Lave & Wenger, 1991). Research in science learning shows that students from traditionally non-dominant backgrounds hold a variety of forms of cultural, linguistic, and embodied knowledges, experiences, and resources that often might be at odds with "settled" expectations of normative science content and teaching (Bang, 2016). |
| "The first time that I understood [science] when she [teacher] was explaining about combustion and heat. When the car builds a lot of heat pressure the engine's eventually going to blow up. And she had a talk and I was automatically saying oh yes, that's like a car. As soon as it reaches its highest point it blows up. But no, most of the time we need to follow a URL, or a YouTube, or those virtual labs. Maybe they think they try to make it in our times. But I bet they learned all this with 3D objects, cars, we can make a wooden inclined plane and roll a toy car. I do not know teachers are getting lazy thinking to use a technology. Just sit there. Good luck learning it. Good luck. Hopefully you'll do it and go for it." (Davon -G. B) | The students' responses to the technology-mediated learning in the virtual labs puts a visible fissure in the connection between the pedagogical assumptions embedded in the notions of efficiency and the assumptions related to student's "technological savviness." Davon's "well wishing" sentiment is particularly poignant in the face of all that is at stake for his emerging science identity. In the figured world of this science classroom, students are reminding us that the social and haptic aspects of learning act as valuable mediators of holistic and "connected" science practices. Otherwise they risk creating epistemic, conceptual, and ontological dis-identification with science knowledge and reproducing docile bodies that will "just sit there" and maybe have "good luck." |

## Discussions and conclusion

In thinking about the disconnect we uncovered between what we, educators and researchers, might think is occurring in terms of digital technology-mediated activities/learning, and what is *really* going on in the "figured worlds" of students, we are reminded that technology is a "human activity," laden with complex values and subjectivities. Our challenge as educators, researchers, and innovators in the learning sciences is to find the ways to harness collective and heterogeneous epistemologies and ontologies into the designs and utilization of digital learning technologies in formal learning environments. It is important that future studies consider how new digital learning technologies contribute to not only students' knowledge construction, but also their diverse ways of knowing and being, their long-term identity trajectories (Bell et al., 2017) in ways that equitably support and validate their episto-ontological developments and evolving identification with disciplinary knowledge and practices as enacted in formal learning settings.

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