Policy, practice and student experience:
Teaching and learning science in a linguistically superdiverse setting

Objectives

This study describes the experience of learning and teaching science in a linguistically superdiverse urban high school, as situated within the school's cultural and historical context. In particular, we focus on:

1. The policies and practices that the school and district have adopted in response to the population's rapid demographic changes
2. The ways in which the school's science teachers have experienced these new policies and practices
3. The experiences of emergent multilingual learners (EMLL) in science classrooms.

Situated within a larger research project that aims to develop and provide professional learning experiences for science teachers, our goal in this study is to understand the complex nature of a rapidly changing educational ecological system. We accomplish this goal by characterizing one school's existing attempts to meet the needs of its learners in the science classroom, while highlighting the diverse experiences of EMLLs, who have been historically marginalized and frequently homogenized under the label of "EL" (English learner).

Theoretical Framework

American schools are becoming more linguistically diverse due to immigrants and resettled refugees coming from around the world through diversified migration channels (e.g., refugee programs, undocumented movement, work permit programs). These rapidly-changing student demographics bring to many U.S. classrooms what Vertovec (2007) referred to as *super-diversity*. In super-diverse classrooms, students come from varied migration channels, immigration statuses, languages, countries of origin, religions, and socioeconomic backgrounds, which contribute to new and complex social configurations of the classroom. Meissner and Vertovec (2015) argued that super-diverse societies require the development of new methodologies, in order to understand their complex social contexts and conditions as well as practices and policies for social services to address new needs of individuals and communities. In education, super-diversity implies that traditional approaches may not be sufficient (Gogolin, 2011), including those that simply dichotomize EMLLs versus native English speakers (NES), assume that EMLLs share uniform experiences, or solely focus on certain ethnic groups and their traits for teaching them. Super-diversity urges educators and researchers to generate nuanced understandings of the complexity that it brings to bear in educational settings and draw on such understandings in designing new instructional approaches.

In our paper, we aim to contribute to the production of a nuanced understanding of the complexity of teaching and learning in super-diverse science classrooms. In doing so, we are inspired by the work of Lee and Hawkins (2015), which highlights the importance of multiple dimensions of contexts and sociocultural approaches to policy in examining EMLLs' education.

Drawing on the idea that multiple nested layers of an ecological system impact individuals' development (Bronfenbrenner, 1994), we seek to understand EMLLs' learning experiences in science classrooms situated within district, school, and classroom level contexts. We will highlight a wide range of EMLLs' experiences within their science classroom context and discuss how super-diversity in a classroom contributes to the complexity of student experiences.

Methods and Data Sources

We investigated Riverview High School (RHS), a linguistically super-diverse high school, located on the outskirts of a metropolitan Midwestern city. Over the last decade, RHS has seen dramatic demographic shifts (See Figure 1). The Riverview area has become home to over 14,000 resettled refugees from Myanmar/Burma, and a smaller but growing number of refugees and immigrants mainly from Mexico, Honduras, Syria, and Congo. Currently, RHS students speak 32 languages (including many Burmese dialects, Spanish, Arabic and Swahili). See Figure 2 for the school's current enrollment by language status.

Drawing on the traditions of educational ethnography, we visited the school once per week over one school year, engaging as participant observers (Spradley, 1980) in eighty-eight class periods in science and English as a New Language (ENL) classrooms, writing field notes (Emerson, Fretz & Shaw, 2011) for each class period. We included ENL classrooms to observe any potential differences in student engagement compared to the science classes. We also conducted ethnographic interviews (Spradley, 1979) with eleven science teachers, four ENL teachers, two school tutor/translators, two school administrators, two district EL[1] personnel, and twenty-three EMLLs who were classified by the school as EL. Student participants included speakers of twenty different languages, including several Burmese dialects, Spanish, Arabic, and Kibemebe. Twelve students spoke three to six languages, and five students utilized interpreters to facilitate their interviews. We analyzed our data thematically (Braun & Clarke, 2006), driven both top-down from our research questions and bottom-up from the data. We then looked across the themes of the various data sets (student interviews, teacher interviews, admin/staff interviews, classroom observations) for connections between district/school policies, teacher practices, and student experiences.

Findings

District & School Policies and Practices

In response to the demographic shifts, RHS and the school district have adopted a number of new policies and practices to better support students. For example, the district adopted the World-class Instructional Design and Assessment (WIDA) standards and assessments to identify ELs, and to support and assess students' English proficiency. The district also sends teachers to workshops to learn about the Sheltered Instruction Observation Protocol (SIOP) model of planning, teaching and assessment to support EMLLs, and appointed a "SIOP Expert" at each school.

At RHS, the SIOP expert has a daily planning period dedicated to supporting content-area teachers. The district also created an ENL department at RHS. Students with WIDA scores of 1-4 take an ENL class daily, until they are reclassified as fluent English proficient. Teachers are expected to modify assessments for students with an overall WIDA score of 1 or 2. RHS also employs three tutor-translators (in Burmese/Hakha, Spanish and Arabic), who support students in and out of the classroom. This year, RHS created a sheltered instruction Biology class, due to the "amount of vocabulary required in the content." District and school administrators review these policies and practices annually, adapting them when necessary to better meet teachers' and students' needs.

Experiences of RHS Science Teachers

The RHS science teachers have implemented these policies and practices in a variety of ways. For example, the Biology teachers have collaborated to develop "EL versions" of all Biology chapter tests. Twelve of the fourteen science teachers at RHS have attended SIOP training. Most science teachers engage students in collaborative groups, to facilitate both science learning and English proficiency. All science teachers attempt to leverage the linguistic resources in the classroom by pairing EMLLs with students who speak a shared language (when possible).

Teachers noted a number of challenges to implementing the school and district's EL policies and practices. Some science teachers questioned the accuracy of the students' WIDA scores, noting that many Level 3-4 students (who do not receive EL versions of assessments) struggle to succeed on unmodified science exams. Furthermore, many teachers cited modifying assessments as a particular area of challenge. The only instructions they recall receiving were to reduce the number of answer choices or reword the questions and/or answer choices, yet no specific support on how to reword assessments was provided. Several teachers pointed out that the district does not provide EL-specific instructional materials, and that the current curricular materials are inappropriate for ELs. For example, the Sheltered Biology teacher calculated the Fry Readability level of the Biology textbook as "second-year college student."

While most teachers have attended the SIOP training, many noted the lack of support in implementing that training in their classroom. As one teacher explained, "It wasn't enough that I could utilize to help me through the struggles that I face in my classroom. There's always a huge gap there between being trained and when you come back to the room." Teachers also noted their under-utilization of the school's tutor-translators, due to teachers' unclear understanding of the tutor-translators' roles. In addition, the ENL teacher who serves as the school's SIOP expert noted the challenge of supporting content-area teachers, saying, "I was told, 'We don't want you invading people and telling them how to teach. We want people to come to you,' and I'm like, 'But people don't come to me very often, so how do I get into classrooms without just going in there?'"

Experiences of RHS EL students

Students' experiences in response to district/school/classroom policies and practices demonstrate their heterogeneity as a population as well as the complexity of supporting them as

learners. For example, while some students expressed a wish that RHS would employ a tutor-translator in their home language, others described why they do *not* utilize this resource, citing the additional time it requires or the desire to learn independently: "I would not want the interpreter to be with me in a class, because I want to think and work by myself and figure things out by myself." Some students expressed a desire for instructional materials in their home language while other students did not, noting that they do not read in their native language.

Students also had varying feelings about collaborating with other students in class. Some students prefer to work with a speaker of their home language, explaining, "If she speaks to me in [my language], it's easier to understand." Conversely, other students pointed a disadvantage of this pairing: "I didn't really have time in class [to do my own work] when I had to translate [for my partner]." In regard to languages that their groupmates spoke, some students enjoyed working with native English speakers (NES), because, "you can improve your English" and "get a lot more work done." Others, however, described their discomfort working with NESs, saying, "If we [have to speak] English, every time it make me nervous." Due to this discomfort, they would rather work with other EMLLs (even those who speak a different home language) because they feel less pressure to speak perfect English. Yet others described negative experiences working with EMLLs of different languages, explaining, "I'm the only one who don't speak their language. It's kind of like White and Black, like discrimination."

While students' experiences varied with respect to many district/school/classroom policies and practices, they converge around one important point -- EMLLs have the same needs for relationships and belonging as any teenager. For example, students unanimously desired strong relationships with their teachers and fellow students. One student explained, "I would recommend for some science teachers to be more closer to their students, try to help them more, make them feel comfortable to ask questions." Another noted "It all depends on whether we [students] get along. Whether they speak [my language or not], if they're not willing to help, it doesn't work." Perhaps most importantly, students expressed a desire to not feel singled out. For example, one student explained, "My teacher would give Test A [unmodifed version] and B [EL version]. I'm the only one B, right? And the color's different. Why do I have to have a different color?" Another student expressed resistance to being the only person in class who might utilize a tutor-translator, and thus did not use that support at all.

Our findings characterize the inherent complexity in supporting EMLLs. While the district and school leverage vast resources to support teachers and students, those resources are often under utilized. In general, teachers were willing to implement district- and school-recommended policies and practices, but they needed additional support to understand *how* to best utilize them. Student responses shed light on the heterogeneous nature of EMLLs' experiences in school, while also illustrating how a school's best efforts to provide support and resources can unintentionally result in students feeling "othered" (e.g., Goodwin, 2003; Kohli & Solórzano, 2012).

Scholarly Significance

This study contributes to the literature around the social context of education by highlighting a high school in which many different languages are spoken, thus contributing to a more complete picture of the range of school experiences in the United States. Our findings call for more nuanced understandings of super-diversity in the context of science classrooms and for designing learning environments that sufficiently address specific conditions of super-diversity. Our presentation will invite researchers and different organizational stakeholders to consider new possibilities for teaching science in linguistically super-diverse classrooms.

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Footnotes

[1] In this paper, we use the abbreviation "EL" (for English learner) when referring to specifically to district or school policies, practices, departments, etc., to reflect the district's use of the term.

Figures

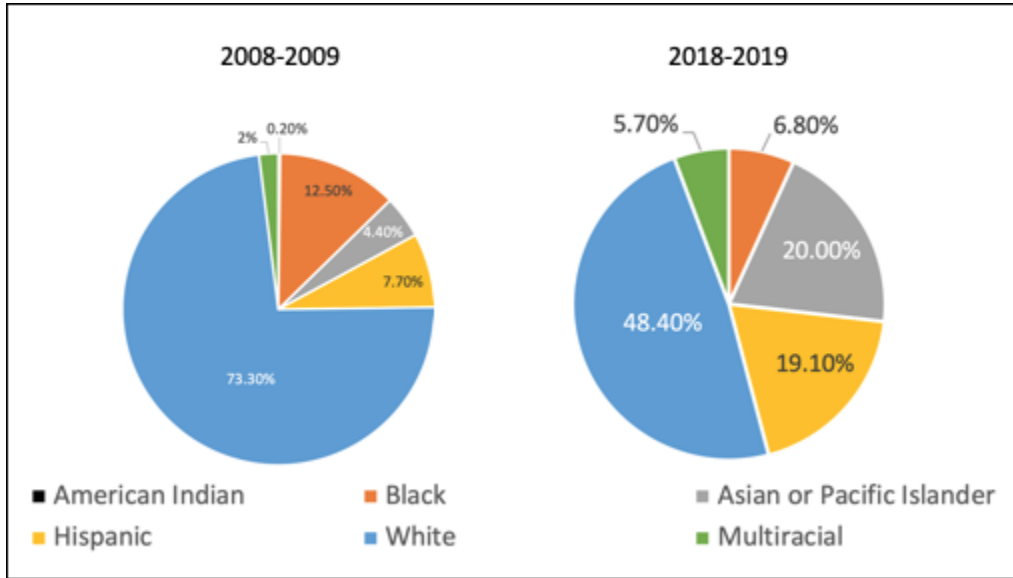**Figure 1**. Shifts in RHS Enrollment by Ethnicity (from state Department of Education website)

Figure 2. 2018-2019 Enrollment by Language Status