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NEGOTIATING IDENTITIES IN MIDDLE SCHOOL SCIENCE:
IMPACTS ON STUDENTS' PERCEIVED EXPERTISE
AND SMALL GROUP PARTICIPATION

by

Taylor Dexter

A thesis submitted in partial fulfillment
of the requirements for the degree

of

MASTER OF SCIENCE

in

Education

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2020

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ABSTRACT

Negotiating Identities in Middle School Science: Impacts on Students' Perceived

Expertise and Small Group Participation

by

Taylor Dexter, Master of Science

Utah State University, 2020

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Department: The School of Teacher Education

English-only instruction represents the most common learning environment experienced by Multilingual Learners (MLs) at the K-12 level in the United States. Spanish-speaking MLs face challenges in school as a result of widely circulating stereotypes that position them as less capable of succeeding in STEM contexts than their White and Asian peers (Blaine, 2013; Jimeno-Ongrum et al., 2009) and the perception that they value formal education less than other groups (Valencia & Black, 2002). Regardless of the intentions of English-monolingual teachers and students, Spanish-speaking ML students, whether they are considered “fully” bilingual or “English Language Learners” by the school, must contend with being heard through a deficit lens in the school setting (Flores & Rosa, 2015).

This linguistic anthropological case study, conducted in a 7th grade science classroom, provides insight into how students enact equitable and inequitable participation in small group science learning. The analysis applies discourse analysis “beyond the speech event” (Wortham & Reyes, 2015) and centers on negotiations of

local school-based identities within a small heterogenous lab group. By examining how students enact identities such as the “scientist” and the “good student,” while also invoking language ideologies related to Spanish and English, this thesis explores how stereotypes surrounding multilingual and Latinx students held by white English monolingual peers shape students’ positioning as experts in the science classroom. This study also examines the consequences of students’ social identification practices for their learning opportunities and discusses the potential for translanguaging pedagogies to reshape peer dynamics to promote more equitable group learning. Revealing the discursive practices that come to marginalize Latinx and multilingual students in their peer groups offers researchers and educators critical insights needed to develop tools for creating equitable classrooms.

(83 pages)

PUBLIC ABSTRACT

Negotiating Identities in Middle School Science: Impacts on Students' Perceived
Expertise and Small Group Participation

Taylor Dexter

This thesis investigates how students in a linguistically diverse 7th grade science lab group interact and position each other's capabilities within a STEM context. These capabilities are discussed in terms of how the identities local to a particular 7th grade science lab group of "good student" and "scientist" are assigned, challenged, and strengthened. These interactions are instances of identities and patterns (pathways) of identities being negotiated. This thesis' analysis focuses particularly on how the identities of being Latinx and multilingual affect these negotiations in the terms of the local identities ("good student" and "scientist"). This analysis sheds light on how Latinx students come to be underrepresented in STEM fields and how the K-12 science classroom context contributes to this marginalization. Further, this thesis offers suggestions for instructional interventions that may better support the linguistic and identity-based needs of multilingual students in English-only classrooms by shifting students' and teachers' perceptions towards an asset-oriented view of multilingualism.

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CHAPTER I

INTRODUCTION

Within STEM fields, certain minoritized groups based on race and gender are underrepresented (Lewis, Menzies, Nájera, & Page, 2009; Starr, 2018). While women are woefully underrepresented within STEM fields and further research and possible solutions are needed in order to address this disparity, the focus of this thesis is on the underrepresentation of Latinx students. This underrepresentation is visible within the enrollment of undergraduate students in science and engineering programs, only 13% of whom described themselves as Latinx in 2015 (National Science Board, 2018), despite making up 21% of eligible students (United States Census Bureau, 2018). This disparity grows more evident when considering the amount of Latinx doctoral students within STEM programs, which in 2015 (National Science Board, 2018) was 7%. This disparity in representation is not isolated to secondary education but is a product of micro- and macro-social phenomena. For example, macro-level racial stereotypes or ‘storylines’ directly affect the micro-level, as students’ individual racial identities serve as a liability for being perceived as incapable of learning in school and in science (Nasir, Snyder, Shah, Ross, 2012).

Within the K-12 context, the number of students labeled as English Learners¹ enrolled in public schools in the US has more than tripled since 1980, rising from 7% to

¹ Many labels are used to describe students that speak multiple languages within K-12 education in the US. Labels, such as ‘English Learner’ or even ‘Emergent bilingual’ can lead to or be reflective of deficit thinking, because these terms highlight students’ lack of proficiency in the target language (Barbian, Gonzales, & Mejia, 2017). In order to challenge this deficit labeling and attempt to recognize the complex linguistic growth occurring within these students in two more languages, I will be using the label multilingual.

23% in 2015 (Camarota, Griffith, & Zeigler, 2017). Schools in the US have had some success in addressing the needs of these learners in classrooms. The graduation rate for students labeled as EL increased from 57% in the 2010-2011 academic school year to 67% in 2015-2016 (U.S. Department of Education, n.d.). This improvement may be related to the efforts of researchers, policy makers, administrators, and teachers across the country. These efforts include research-based instruction (e.g. using narratives, social media, transliteracy) (Danial & Mokhtari, 2015) and encouraging teachers to act as researchers in their own classrooms (Brindley & Crocco, 2010). Teachers are also supported in their endeavors to be culturally and linguistically responsive by recognizing, including, and enriching the classroom with students' cultures (Trumbull, Rothstein-Fisch, Greenfield, & Quiroz, 2010; Freire, 2005) and extending language learning tools into content-area classes (Fisher, Frey & Rothenberg, 2008). Furthermore, many teachers engage in class discussions with K-12 learners about linguistic and cultural differences and their impacts on students and teachers in and out of the classroom which Hooks (2010) refers to as critical thinking and Rymes (2016) advocates for as a component of collaborative classroom discourse analysis (Rymes, 2016). Despite the improvement in graduation rates of EL students, when compared to the graduation rate of students without the label of EL, 85% in 2015-2016 (U.S. Department of Education, n.d.), it is evident that there is still a need for much research and reflection in regards to the practices and policies in place in order to improve multilingual students' participation, their learning opportunities, and ultimately their academic success.

In order to foster more equitable environments for multilingual students, 'just good teaching' (JGT) (de Jong & Harper, 2005) is not enough. Approaches that start to

provide the support needed in a racially diverse and multilingual classroom include instructional tools such as Content-based Instruction (CBI) (Brinton & Holten, 1997) and the use of the SIOP Model (Vogt & Echevarria, 2007). While the implementation of these approaches is a good starting point to addressing equity in classrooms, research reveals that the assumptions many teachers have regarding equity, and the decisions made about instruction based on these assumptions, also need to be scrutinized (Banks & Banks, 1995; Ansalone, 2009). Despite the teachers' good intentions, their assumptions about equity and about their students can inadvertently perpetuate marginalization. Researchers have proposed many ways in which these assumptions can be challenged, one of which is to bridge students' diverse backgrounds, knowledge, and experiences (Funds of Knowledge) from home with school-based knowledge (González, Moll, & Amanti, 2005). Another movement within education is to provide the necessary training in order for teachers to recognize their social positions in students' lives and subsequent influence, which "requires...involvement in and dedication to overcoming social injustice" (Friere, 2005 p.104). Relatedly, approaches in culturally sustaining pedagogy strive to educate teachers to address "one of the most critical, under examined issues...the 'incredible whiteness of (being) teacher educators,'" (Paris & Alim, 2017 p.153). These approaches seek to validate and utilize students' unique cultural backgrounds to enrich the learning experience within K-12 classroom and challenge status quo practices that may harm multicultural students. However, culture cannot be separated from language. This means that in order to fully realize this goal of equitable pedagogy for multilingual students, language practices and policies must be addressed. One such language practice, translanguaging (Otheguy, García & Reid, 2015), allows students to use their full

linguistic repertoire, something that is currently difficult to accomplish considering unspoken expectations and norms about the use of academic English in educational contexts. More research is needed on how instructional strategies designed to promote equitable science learning environments, by facilitating translanguaging or other practices, fare in their success at generating or failing to generate those equitable outcomes. This thesis seeks to add to the literature by critically analyzing instances of the social positionings of multilingual youth in small group science learning in a lesson that was designed to create equitable conversations. Through examining students' language practices and the negotiations of identity that are inherent in them, I reveal implications for the design of instruction to support multilingual Latinx students' access to participation and learning opportunities within a science classroom.

One challenge that Latinx students experience in K-12 education in the U.S., is the existence of pervasive stereotypes which include the idea that Latinx students are less capable in succeeding in STEM contexts than their White and Asian peers (Blaine 2013; Jimeno-Ingrum et al. 2009) and the perception that they value formal education less than other groups (Valencia & Black 2002). These stereotypes construct and reflect "widely circulating models of identity" (Wortham, 2006, p.8), meaning that while these stereotypes do not represent any one person, they provide a model of what it means to be a Latinx student in the imaginations of students, teachers, and administrators². These models of identity were created over a long "timescale" (Lemke, 2000) through decades

² While widely circulating models of identity provide framework for what it means to be a Latinx student in the imaginations of non-Latinx students, teachers and administrators, this qualification of "non-Latinx" was purposefully excluded to convey that this model of identity is also used to construct what it means to be a Latinx student in the imaginations of Latinx students teachers and administrators. Even though this typification serves to marginalize their own construction of identity within academic and STEM contexts, these pervasive stereotypes are acted out by all who have been socialized within the US whose institutions have been shaped by western ideology, colonization, and other historical legacies.

of sociohistorical events within the U.S.. Because of this, as Latinx students construct their identities within a K-12 context, the racial identities imposed on them through racial and academic socialization greatly influence their learning and engagement in school settings (Nasir, Synder, Shah, Ross, 2012).

In order to understand how these models of identity affect the way Latinx students participate in STEM contexts, it is vital to examine intersections of longer timescales in which these widely circulated models of identity are created and shorter timescales in which these models of identity are maintained or challenged. This can be accomplished by closely examining Latinx students' speech events within STEM contexts and how these micro-social interactions relate to macro-social models of Latinx identity. An analysis of these intersecting timescales reveals how an accumulation of speech events involving Latinx students and other students contributes to the creation of locally categorized identities. Smaller timescales or micro-social interactions are crucial within the analysis of social disparities and discussions of possible solutions because they accumulate to produce macro-level phenomena such as underrepresentation of Latinx students within STEM fields (Braden, 2020).

This case study analyzes the interactions of a small, heterogenous lab group in a 7th grade science class. This group is made up of multilingual, Latinx students and monolingual, White students. This lab group's micro-social interactions revealed two salient local identities: the "good student", the "scientist", which were both shaped by intersecting identities related to English expertise. The analysis of these negotiations of identities provides important insight into how macro-level stereotypes of Latinx students

contribute to their micro-level positionings as more or less expert in a science classroom and in STEM education more broadly.

Linguistic research within education is largely focused on the mechanics of language. By shifting the focus of research from the use of language, such as code-switching³, in peer interactions to instead concentrate on how identity is constructed through peer interaction in heterogenous peer groups, this study provides insight into how students construct equitable and inequitable participation structures in the classroom. This study examines peer interactions in a 7th grade science class in which instruction is given exclusively in English. This is particularly relevant to the experiences of many multilingual students in the U.S., as they predominately experience English-only instruction (Corson, 2001). Another goal of this study is to examine how the relationships between language and expertise can serve to create instances of support or marginalization for students in the classroom that may go unnoticed by the teacher and may be able to be addressed through instructional interventions such as translanguaging⁴. These goals are addressed through the following research questions:

- 1) What signs indicate the local identities of “scientist” and “good student” and how do the negotiations of these signs contribute to emerging/established local identities?

³ Code-switching is a linguistic practice employed in educational settings that views multilingual students’ known languages as discrete and encourages students to alternate between them.

⁴ Unlike code-switching, translanguaging views students’ linguistic repertoire more holistically rather than made up of discrete languages. Translanguaging encourages students to make use of all of their known languages within their linguistic repertoire simultaneously (Otheguy, Garcia, & Reid, 2015).

- 2) How are the identities of being a Latinx and a multilingual student within a small heterogenous lab group entangled with other emerging/established local identities?
- 3) How do the negotiations of these identities affect students' ability to participate meaningfully to scientific conversations in a small heterogenous lab group?

CHAPTER II

LITERATURE REVIEW

This chapter lays the foundation for the analysis and findings of this thesis by discussing the interdependence of culture and language (Section 2.1), and the role of race in the distribution of social power (Section 2.2). These complex relationships are entangled and enacted through the use of language (2.3) which leads to the social positioning of Latinx students within peer groups in science classrooms (2.4). Within this case study, positionings of students are analyzed using a linguistic anthropological approach, and vital to understanding this approach is understanding the difference between a model of identity— a stereotypical view of a certain group of people— and local identities which are context-specific (2.5). Further, *pathways of identity* describe the ways in which these identities are achieved through social negotiation, which is the basis of this study's analysis (2.6).

2.1 The Inextricability of Culture and Language

Culture has been defined in countless ways throughout history, however, all definitions point to the fact that culture is pervasive in human life, being made up of knowledge, morals, traditions, adapting to one's environment, patterns of habit, etc. (Nababan, 1974). Culture could not exist without language; it is the means by which culture is transmitted and perpetuated (Brown, 1994; Jiag, 2000). At the same time, culture is the basis of language and greatly influences its use (Nababan, 1974). Because of this close and interdependent relationship of language and culture, learning a new language, or a new context-specific style of language, will inevitably involve becoming more fluent in the new cultures' norms, enabling learners to develop communicative

competence (Hymes, 1972) in the language. This context specific communicative competence does not necessarily mean that speakers will adhere to the academic standard for the named language (a political determination), rather, they will use their full linguistic repertoires, a mix of their known languages, in order to meet the communicative demands of the varying contexts they come in contact with (Pennycook, 2010).

Communicative competence is much more than grammatical competence in a target language but requires competency in the target culture (Sun, 2013). Just as multilingual students can struggle as they attempt to apply rules of a known language to target languages (e.g., through language transfer or interference; Swan & Smith, 2001; p. xi), they too can transfer cultural knowledge and expectations to target cultures. While much research on language acquisition focuses on the linguistic challenges learners can face, Sun (2013) argues that “the most difficult thing for the language learners to deal with in their study of the foreign language is not the linguistic forms or grammar, but the cultural difference” (p.371).

Other studies, while they may not address culture head-on, because language and culture are intertwined, allude to this idea that culture affects language in social interactions. Coyoca & Lee (2009) offer an example in which a group of Spanish-English speaking students in an English classroom are attempting to play a new game. While none of the students within the group understood the game nor played the game correctly, only the student perceived to have limited English proficiency, was referred to by her peers as “not following the rules” (Coyoca & Lee, 2009, p.274). This lack of understanding (or “not following the rules”) is attributed to the student’s lack of

proficiency in English. This instance could be explained by the belief that these students held that English is more valued than Spanish within the classroom setting. For example, even in bilingual schools, English is often found to have more social capital among students as evidenced by its use at lunch and on the playground when no language was designated for use by the teachers (Freeman, 1996). This alludes to the idea that students associated with minoritized languages and cultures can be valued as lesser in an environment where a dominant language/culture exists (e.g. educational contexts).

Culture shapes social positioning and identity within small peer groups. Some researchers, including Guan et al. (2016), advocate for a focus on culture within the study of linguistic interactions (Malsbary, 2014; Jones & Trickett 2005; Trickett & Jones 2007). It is impossible for language to be translated and processed without cultural information due to the fact that communication is built from “cultural beliefs, values, and norms” (Guan et al., 2016, p. 150). Trickett et al., 2010 goes as far as to say that in the case of children translating for their parents, “interpretation of the new culture to parents or other adults ... may or may not involve linguistic translation” (p. 90).

One of the issues this thesis addresses is how researchers and educators can unpack how stereotypes about Latinx and multilingual students that circulate in society at large impact the micro-social interactions which occur in a K-12 context. While the code (language) used by students may share the same name, “English,” students may nonetheless play with registers to construct their local classroom culture and social relationships. The interactions analyzed in this thesis are nearly exclusively in English, yet the social positions that are constructed are related to the multilingual students’ linguistic and cultural backgrounds. I investigate how two multilingual students from

historically marginalized backgrounds within science education (Oscar and Miguel) experience marginalization related to their perceived linguistic (and subsequently cultural) backgrounds which is achieved through social action mostly devoid of the use of either students' home language(s).

2.2 Raciolinguistic Ideology

Raciolinguistic ideology is a term coined by Flores & Rosa (2017) to explain the inextricable relationship between race and language. This relationship in the US has roots within western colonization of the Americas as Europeans co-naturalized certain races with certain languages in order to create “Others” (p. 19) based on race. The Other, defined as outside the language and race of White Europeans, was devised in order to craft a basis for White European superiority. A *raciolinguistic* perspective seeks to better understand how the relationship between race and language has shaped the socio-historical events leading to current racial and linguistic constructions and how these are maintained or dismantled.

Flores & Rosa (2017) give an example illustrating the effects of the co-naturalization process on Latinx Spanish speakers: two side-by-side US-based advertisements, one for learning Spanish and one for learning English. In the advertisement for learning Spanish, there was a white male dressed in more formal business attire, and the advertisement for learning English had a brown-skinned man in a casual shirt. This difference in marketing is evidence of generally held beliefs within the US about race and language. These beliefs “align Spanish language learning with the consolidation of white male socioeconomic superiority and English language learning with nonwhite male (im)migrant labor subordination” (p. 640).

Language and race are impossible to separate within the discussion of social positioning in the U.S., and this inseparability has important consequences within the K-12 context. Because of this inextricability, in this case study, when talking about Miguel's and Oscar's identities as multilingual students and Hope's and Abby's identities as monolingual students it is imperative to include in the same discussion their identities as Latinx or White students. When analyzing the data, the negotiation of these racial and linguistic identities was done simultaneously.

Understanding the impact of this relationship between language and race is especially key in this analysis, as the lab group in this study is both racially and linguistically heterogenous. Within science classrooms, local identities and *raciolinguistic ideologies* within small group work have been found to be crafted and negotiated simultaneously (Braden, 2019). In a U.S. science classroom, this relationship emerges as science expertise is constructed in conjunction with the crafting of an ideology that views English as more appropriate to communicate scientific ideas, and in turn excludes Spanish-speaking students (Braden, 2019). This thesis builds on prior work regarding the ways in which languages other than English are undervalued within scientific conversations among peers by focusing on how this undervaluation plays out in a K-12 mainstream classroom in which English is the sole language of instruction—a context overlooked in existing research.

2.3 Linguaging and Translanguaging

Linguaging is a term popularized by Swain & Deters (2007) and refers to the crafting and negotiating of meaning through the means of language. It is through the process of linguaging that reality is spoken into being. When linguaging occurs within a

peer group, the reality is negotiated and crafted as multiple speakers engage in languaging. This is evident in the ways students position themselves and their peers through linguistic signs within speech events.

Cen Williams (1994) first used the term translinguaging (*trawsieithu* in Welsh) to describe a pedagogical practice he used which encouraged students to employ both English and Welsh in his classroom. The definition of translinguaging has since broadened to mean “the deployment of a speaker’s full linguistic repertoire without regard for watchful adherence to the socially and politically defined boundaries of named (and usually national and state) languages” (Otheguy, Garcia, & Reid, 2015, p.1). This practice within education is often confused with code-switching, which is when a bilingual or multilingual person switches between distinct languages. While this practice of code-switching encourages students to use multiple languages in a classroom, research pertaining to code-switching assumes a monolingual paradigm that treats multilingual students’ linguistic repertoires as the sum of two or more discrete languages (Li & Luo, 2017). Translinguaging, in contrast, means that a speaker can employ all of the linguistic features of their known languages simultaneously, allowing them to respond to various linguistic situations.

Within the U.S. K-12 context, there has been a history of English-only policies within classrooms (Corson, 2001). While these policies currently vary in their implementation across the U.S. in different states, there is still an implicit expectation for students to speak using an academic register, which, because most educators within the U.S. are White English speakers, becomes defined by those speakers as academic

English. Consequently, Latinx and multilingual students are often barred from using their full linguistic repertoire which impacts their classroom participation and learning.

2.4 Positioning of Latinx and Multilingual Students in Peer Groups and Access to Participation within STEM classrooms

One characterization of how students participate in peer groups, describes students being positioned by each other into a low-status role of non-knower or a high-status role of knower (Lee, Hill-Bonnet & Raley, 2011; Bianchini, 1997). The power relations created from these socially constructed relationships can either benefit students academically in the classroom or be detrimental to their academic success (Lee, Hill-Bonnet, & Raley, 2011). When these positionings occur, it is often the Latinx, multilingual student who is perceived as less proficient in the target language who is marginalized or given a negative academic identity ('non-knower'), and as this role continues, the role is reinforced (Lee, Hill-Bonnet, & Raley, 2011 p. 308). This role of being a non-knower in a peer group can constrain learning opportunities for multilingual students (DaSilva Iddings & Katz, 2007). An example of this kind of relationship emerges in a study by Bianchini (1997) which looked at small group work in a science classroom. Miguel, a Latinx, multilingual student who was identified by the researcher as being a "low-status" student in the class (based on survey data and peer group relationships) was excluded from participating in group work while those students in the group with a "high-status" talked the most (Bianchini, 1997, p.1055). This means that those in the "non-knower" social position have fewer opportunities to meaningfully participate in small-group and whole class activities when compared to their peers. This is significant because student academic achievement has been directly linked to

participation in the classroom as explained by Bianchini, (1997) who claims, "a student's rate of on-task talk predicts his or her performance on science unit tests" (p.1056).

Because of this, there is a particular challenge with Latinx, multilingual students in the classroom as their positioning in the classroom, associated with a lack of proficiency in the target language or their peers' and teachers' perception of a lack of proficiency, can act as a barrier to participation in the classroom.

When students are placed in roles of a 'knower' or 'non-knower,' "the 'true' ability level of the student does not seem to matter as much in organizing interactional structures, but rather how the student is perceived as an able or a less able student in class" (Lee, Hill-Bonnet & Raley, 2011, p.323). This implies that if Latinx, multilingual students were to develop the necessary proficiency in the target language, due to their social positioning within the classroom, they may still be barred from participation in the classroom equal to that of their peers of similar language proficiency. When students are positioned within these low- and high-status identities, the high-status student can take over activities or assignments completely, completing it for themselves *and* for their low-status peers, leading to the low-status student disengaging from the situation, considerably constraining their opportunity for meaningful participation in the classroom (DaSilva Iddings & Katz, 2007).

These positionings are complex as students are positioned by others, but also at times, are active in their own positioning or the positionings of those that belong to a shared marginalized group. This is to say that while Latinx students may be positioned as less capable in academic contexts than their White peers, both White and Latinx students can both be involved in these positionings and contribute to the construction of

inequitable participation structures whether or not they are conscious of their role in carrying out the linguistic and cultural norms of a U.S. mainstream, English-only K-12 classroom (Corson, 2001).

While research done on student interaction within peer groups usually addresses to some extent the role of culture in languaging, the topic of culture takes a back seat to the linguistic features of these speech events. For example, a study done by Oliveira & Sadler (2008) focused on characteristics of effective collaboration between students in small group settings in a college science class. While the focus of this paper was to examine in detail how students participate in small groups, whether in a more combative or passive way, and how this would affect the quality of the work students were able to create, the researchers did at times use culture and social reasons in order to explain some of the patterns that were seen in these small groups. Later, Oliveira & Sadler (2018) continued their research and offered the explanation that in small groups, minoritized, low-status students, can be seen as less capable and that "high-status students talked more, interrupted more often, were more successful in introducing ideas and tended to receive more feedback from their peers" (p. 653-654). Although invaluable, these studies offer little insight into how positions of "high" and "low" status are crafted through social interactions in the classroom – a gap in the literature this thesis contributes to addressing.

Research focusing on small peer group relationships and participation in the science classroom has focused on and uncovered some of the possible complexities and challenges that arise for students positioned as low-status with less consideration of adverse effects, if any, that these relationships could pose to the student positioned as high-status (Lee, Hill-Bonnet & Raley, 2011; Bianchini, 1997; Coyoca & Lee, 2009;

Bayley, Hansen-Thomas & Langman, 2005; DaSilva Iddings & Katz, 2007). This paper assesses the complexities of social positioning and examines *how* subsequent social identities are reinforced, and *how* they affect access to participation of those in a peer group relationship not only for the low-status students but for the high -status students as well. This thesis also joins with other scholarship (e.g., Braden, 2019) that challenges the binary notion of status as “high” or “low” to show how social positionings are accomplished as multiple intersecting identities are crafted and invoked. Discussing the reinforcement of social positions within the classroom adds to a growing body of literature at the intersection of science and language education that focuses on how stereotypes—generally accepted beliefs about certain cultures and languages, or labels such as “EL” that may exist within the linguistic, cultural, and racialized norms of instruction—inform the distribution of power (Braden, 2020). Taking into consideration these presupposed stereotypes or beliefs and how they affect individual, discrete speech events in the classroom make it possible to recognize emerging pathways of social action or reinforcement of identities/social positioning (Wortham & Reyes, 2015).

2.5 Models of Identity

Widely circulating models of identity are generally held beliefs about certain groups of people. These models of identity are “typifications— ideas about types of people who are perceived to speak, act, and look in a particular way” (Braden 2019, drawing on Agha, 2007), and are often interchangeable with typifications of pervasive stereotypes such as “Loud black girls”, “resistant black males”, and “disruptive students” (Wortham, 2006). Because both *models of identity* and stereotypes describe these typifications, I will use these terms interchangeably. These models of identity affect local and micro-level

interactions ultimately informing local identities. While participants are free to draw on any models of identity in any moment of speaking, in classrooms, there are particular models of identity that are especially relevant. For example, the local identities examined in this case study (e.g. “scientist” and “good student”) are particularly salient in the local context of a 7th grade science classroom. Two types of stereotypes contributed to the positioning of the students within this case study. First, those related to academic success in science are that of a “scientist”, and the “good student” or “teacher’s pet”. Second, stereotypes related to being Latinx and multilingual were also invoked by students and thus reviewed here.

Scientist

Stereotypes about what it means to be a nerd/geek are spread through public consciousness through mass media; one such artifact is the television show, *The Big Bang Theory* (2007-2019). Bednarek (2012) performed an extensive analysis of the conversations within this show that constructed the televisual character, Sheldon, as a nerdy scientist. Some of these stereotypes include: being unattractive, physically awkward, sexually inexperienced, intelligent, socially awkward, a White male, and interested in technology or science. These stereotypes surrounding the identity of geeks/nerds can also be applied to the model of identity “scientist” because the televisual character, Sheldon, was a physicist and his identity as a scientist was inextricable from his identity as a nerd/geek. Of particular note is the racialized and gendered stereotypes surrounding the identity of a nerdy scientist (Bednarek, 2012), which affects the access to this identity by female students and students of color (Braden, 2020).

Other case studies within the K-12 context reveal the construction of the nerd identity can be more fluid depending upon how these stereotypes take distinctive form dependent on the timescale(s) and context in which they are being simultaneously constructed and applied. Lemke (2000) uses the term *timescale* to situate human interaction within and across time (e.g. second, hour, week, year) in which socio-historical events create identities specific to that timescale or intersection of multiple timescales. When students reject being trendy or cool through their linguistic signs, not conforming to masculine or feminine expectations (Bucholtz, 2011), and use humor to negotiate their “smartness” (Lundqvist, 2019), they draw on models of identity relating to “smart” students circulating across timescales. These case studies (Braden, 2020; Bucholtz, 2011; Lundqvist, 2019) reveal how signs contributing to students’ identities within the classroom are reflective of more general stereotypes of what it means to be a nerd/geek and a scientist.

The same holds true within this case study as some signs discussed within the negotiations of science expertise fall under the broader stereotype of what it means to be a scientist, while others are specific to the local identity science expert. However, the stereotype of scientists more broadly accepted and the local identity of science expert discussed in this thesis are not mutually exclusive, rather, the local identity is the result of the stereotype cultivated over a centuries long timescale intersecting with the local context of a small heterogenous group in a 7th grade science classroom.

Good student

The stereotype of a “good student” exhibits wider variation than what it means to be a “scientist” depending on the given context. Thornberg (2009) studied the moral

construction of the identity of a good student through analyzing the behaviors encouraged through school rules. The implicit expectations of good students are that they would 1) do good and no harm to others, 2) follow norms and rules, and 3) take responsibility and do their best. This widely circulating stereotype of what it means to be a “good student” intersects with particular timescales and contexts to create the local identity of “good student”, borrowing some signs from the widely held stereotype, and some particular to the local identity.

An example of the construction of such a local identity in Lundqvist (2019) describes a student who was identified as a “smart” student. This identity led to him being relied upon by the teacher to provide correct answers to move class activities forward and he was expected to be more docile and well-behaved than his peers. Lundqvist (2019) labeled this accumulation of signs as the local identity of “teacher’s pet”. While these signs that point towards this particular local identity overlap with the signs that point towards the stereotype of a good student as described by Thornberg (2009), the student’s identity as teacher’s pet was entangled within his identity as a “smart” student. The local identity of “good student” discussed within this thesis will draw from the signs which point to the widely circulated identity of a “good student” while specifying what these signs look like with this 7th grade science lab group.

Latinx and multilingual students

Within the U.S., stereotypes about Latinx people are circulated widely including through the use of news media. Some stereotypes of Latinx people present implicitly or explicitly in media in the U.S. include that they: are more likely to engage in criminal behavior, are less educated, hold lower paying jobs, use welfare or public assistance, take

jobs from “Americans”, and are illegal immigrants (Barreto, Manzano, Segura, 2012; Hill, 2011; Yosso, 2002). Stereotypes surrounding the cultural identity of what it means to be a Latinx person in the U.S. are also entangled in a linguistic identity of being multilingual. While being multilingual is sometimes seen as beneficial and a sign of affluence in White America, evident in the growth of dual-language instruction programs in the U.S., multilingual Latinx people are instead seen as “refusing to learn English” (Barreto, Manzano, Segura, 2012, p.4).

Multilingual students in the K-12 context develop linguistically and cognitively within all their spoken languages. Educators often assume that multilingual students are essentially the sum of multiple monolingual students and should perform in any given language as well as a monolingual student of that language. This leads to inaccurate assessments of linguistic and cognitive development and ability and may even lead to ill-informed referrals to special education programs (Solano-Flores, 2016). Errors in assessment of multilingual students reinforce widely circulating stereotypes of Latinx students within STEM contexts as not being as capable as their White and Asian peers (Blaine 2013; Jimeno-Ingrum, Berdahl, Lucero-Wagoner 2009) and the perception that they value formal education less than their peers (Valencia and Black 2002).

The three models of identity discussed in this section (“scientist”, “good student”, Latinx and multilingual students) are key when considering how speech events within this case study point the students’ identities towards these widely circulating models of identity or diverge from them. This divergence is especially key, as it defines the local identities being crafted particular to this context. These local identities of “scientist” and

“good student” share characteristics with the widely circulating models of identity discussed above, with some differences that will be discussed within the findings chapter.

2.6 Pathways of Social Identification

Wortham and Reyes (2015) argue that social identification, or, identity development, unfolds across pathways of interaction. Just as a pathway is constructed of individual stones that when combined reveal a path towards a destination, individual speech events and their linguistic signs, when construed together, drawing from widely circulating models of identity/ stereotypes, reveal a pathway towards an individual’s local social identity. Unlike their literal counterparts, pathways of social identity are more fluid, in a constant state of negotiation, and can be dismantled, change direction, and merge with other pathways of social identity. When these identities appear durable, it is from an accumulation of signs that overwhelmingly point towards a certain identity.

An example of a pathway of social identity given by Wortham and Reyes (2015) describes Tyisha, a student in a ninth grade combined English and History classroom in an urban American school. Throughout an ethnographic study, Tyisha’s identity as a “beast” emerged during a class discussion on the differences between humanity and beasts as laid out by Aristotle. While Tyisha plays an active role in these interactions, she is positioned as less than human by her peers and teachers despite her protestations. Tyisha compares her own goals in life to the goals of her pet cat. This interaction is the initial grab, signifying the beginning of a pathway of social identity that separated Tyisha (the “beast”) from the rest of her peers and teachers (humanity). This distinction carries throughout the year even when the discussion of Aristotle has passed and contributes to

her identity as immoral, unethical, and a liar within the classroom. Wortham (2006) notes that while Tyisha's emerging social identity pathway could be seen as parallel to the widely circulating model of "Loud Black girl" identity, that this stereotype did not completely describe the way in which Tyisha was positioned, and there was a need for signs drawn from her specific classroom context in order to fully explain her emerging local, classroom-level identity. While there are discrete speech events that contain linguistic signs that indicate Tyisha's identity within the classroom, it is only through analyzing them together that the analyst uncovers the pathway that ultimately leads to Tyisha's exclusion from full participation in her class.

As students interact with one another, negotiations of social positionings are continuously occurring across multiple timescales (Wortham 2006, Lundqvist 2019, Braden 2019). By examining discrete speech events, conducting an analysis across them, and considering the socio-historical stereotypes of "scientist", "good student", and Latinx and Spanish-speaking (multilingual) students, the local identities within this small heterogenous lab group emerge.

CHAPTER III

METHODOLOGY

3.1 Ontology and Epistemology

One of the many advantages of qualitative study is that it is a process which is inductive in nature. This means that concepts, hypotheses, or theories can emerge *from* the data rather than gathering data through “deductively testing hypotheses as in positivist research”. The data used for this thesis draws from a larger study focused on evaluating the efficacy of instructional practices that were engineered to encourage equitable participation in linguistically heterogeneous small group settings within middle school science classes through scaffolding conversations between students. The science content topic centered on magnetism and the instruction involved modeling the mechanisms that account for the phenomenon of a floating paperclip. My work with data collected within this larger study, led me to become interested in the relationships within a particular lab group and the power dynamics that seemed to dictate the students’ interactions, and how each adhered to and attempted to disrupt their roles within the power dynamics of the group. It is from analyzing the relationship with this group that the research questions for this thesis emerged:

- 1) What signs indicate the local identities of “scientist” and “good student” and how do the negotiations of these signs contribute to emerging/established⁵ local identities?

⁵ I use the label “emerging/established” local identity because, with each speech event, local identities are constantly defined, redefined, challenged, and strengthened.

2) How are the identities of being a Latinx and a multilingual student within a small heterogenous lab group entangled with other emerging/established local identities?

3) How do the negotiations of these identities affect students' ability to contribute meaningfully to scientific conversations in a small heterogenous lab group?

These questions frame an analysis focused on negotiations of power, “who has it, how it’s negotiated, what structures in society reinforce the current distribution of power, and so on” (Merriam & Tisdell, 2016, p.10), and how the reality of this power inequality is socially constructed. In order to realize this focus on power and socially constructed reality, I will be employing a critical-constructivist paradigm. The critical-constructivist paradigm is informed by my epistemological (regarding the nature of knowledge) and ontological (regarding the nature of reality) beliefs. I take a critical-constructivist ontological view when considering how linguistic signs lend themselves to the socially constructed reality that in turn affects the differential treatment of the students in this study (Hatch, 2002, p.16). Epistemologically, I interpret and discuss the data with full knowledge that the “values of the investigator inevitably influence the inquiry” (Hatch, 2002, p.16). A critical-constructivist methodology allows me to take a transformative stance while interpreting the data, raising consciousness of the social and linguistic issues that can arise while negotiating expertise in the classroom in order to contribute to the body of research that serves to educate and thereby improve the pedagogical practices that directly affect marginalized students in the classroom. Within this thesis, I apply a critical paradigm to the negotiations of expertise between Miguel and Oscar in terms of the local identities of “scientist” and “good student” and how these negotiations affect

their ability to participate meaningfully in scientific conversations in the context of 7th grade science classroom.

3.2 Positionality & Researcher as Instrument

There are certain characteristics and experiences that define my identity as a researcher and have impacted the way I interpreted the data. Some of these characteristics include that I am a native-English speaking U.S. citizen and am White, which can limit my ability to understand the motives and experiences of students of color and non-native speakers of English. In my childhood, I grew up primarily on the East coast of the United States but spent five years of my childhood living overseas (three years in Russia and two years in Germany) where I learned to speak Russian and German and experienced being positioned as less expert in school and other contexts due to my lack of proficiency in the mainstream language of the country. These experiences are what led me to pursue my interest in linguistic diversity in the classroom and have resulted in a particularly strong sense of empathy towards multilingual students. However, I also acknowledge that my racial majority status as a language learner, and as a teacher, I cannot fully understand the experiences that minoritized groups face. Along with the exposure to cultures and languages acquired from living overseas, I gained an intermediate level of Spanish during my undergraduate education. During our time in the classroom for this study, I did speak Spanish with students in the classroom, but the interactions with the group that we recorded for this study occurred predominantly in English.

I have a bachelor's degree in teaching social science which has led to my career as a high school teacher the following subjects at varying levels: English as a second language, psychology, and sociology. Currently, I am pursuing a Master's of Science in

Instruction and Curriculum. This training and experience within education impacts the way I view interactions within classrooms, and it is in part through the lens of an educator that I analyze and consider their meaning. While I have engaged in classroom research as a teacher (e.g. collecting data from my own classes and then analyzing and responding to improve classroom efficacy), this thesis represents my first foray into formal research.

3.3 Context & Participants

The context of this study is a 7th grade science classroom containing monolingual English-speakers, as well as multilingual students of various home languages. At the time of the study the school reported 77.7% of the school's population as non-White ethnic minorities and 31.8% of their students were labeled as ELL. The multilingual students in this classroom spoke mostly Spanish, which could be heard among students at various points during the field work. The group of students from which data was collected consisted of two multilingual students, Miguel, who spoke Spanish and English and Oscar, who spoke Spanish, Q'anjob'al, and English and two monolingual English speakers, Hope and Abby (all names are pseudonyms). Data were collected over five class periods in the spring of 2018. During this time, students were introduced to the phenomenon of magnetism through a lesson sequence that was co-planned with three researchers (including myself as a graduate student researcher), and two practicing teachers. The lesson sequence was based on the Next Generation Science Standards (NGSS Lead States, 2013) and was anchored in modeling one phenomenon, a "floating" paperclip. Students were shown a paperclip on a string that was "floating" off of the table as it was attracted to a magnet. The lesson sequence included 1) students developing

their own model independently, 2) visiting various stations created by researchers to help students gather data about how magnets work, and 3) students revised their individual models, shared their models with their group, 4) developed a consensus model with their group, 5) presented their models to the class, and 6) completed an individual assessment.

3.4 Data Collection

Video and audio recordings of this small-group over 3 days and 4 hours containing 4 participants provide the main sources of data for this case study. While these data were being gathered, researchers circulated the classroom in order to observe and interact with students. Field notes were collected each day during instruction. Informal research meetings also occurred throughout data collection as the research team discussed observations and identified possible directions for data analysis. Student work related to exploring the phenomenon of magnetism was collected including a poster in which students explained in a consensus model (diagram) how a paperclip was attracted to a magnet and what was happening inside both objects.

This study involves few participants, to provide a thorough analysis, or rich description of each focal participant's participation (Duff, 2008, p.43). The small number of participants also allowed collection of more data for each participant, such as video recordings of classroom discourse, writing samples, and researcher's field notes, than would be possible in a larger study. This variety of primary data lends itself to a triangulated perspective of the participants experiences and the strength of the study (Duff pp.43-44; Hatch, 2002, p. 133).

3.5 Case Study- Methodological Overview

Collecting data within a classroom provides a “particular concrete instance of a phenomenon, where researchers might conceivably find relationships among variables or factors of interest” (Duff, 2008, p.34). By using a classroom for this case study, researchers had sufficient background information of the participants, or students, in this study through the analysis of their (students’) performance “within a classroom context or within a particular activity setting,” this background information afforded to research through the context of the classroom allowed us to “interpret influences on L2 comprehension, production, or task accomplishment” (Duff, 2008, p.38). As this study is concerned with examining the role of social positioning on meaningful participation in the classroom, a classroom offers the most relevant context for this case study.

This case study takes place in a 7th grade science classroom within a mid-sized Western city. As previously stated, this thesis emerged from the data gathered in a larger study done with the goal of studying the effectiveness of scaffolds for promoting more equitable small group discussion in two middle school science classrooms. Students that were a part of this larger study provided assent and received parent consent following IRB procedures to be recorded and for that data to be used for research. The data for this paper comes from a classroom in which there were two groups (of 3-4 students each) that had provided consent and assent to participate in this study. Out of these students I focused on one of these groups which had relatively less turnover in order to explore instances of social positioning and negotiation of expertise. This group was also linguistically heterogeneous which enabled me to examine multiple ways in which raciolinguistic ideologies informed social interactions. The context of this study– a K-12

mainstream classroom in which the only language of instruction is English – is particularly important when considering the contributions this thesis provides to existing literature, as much of the existing research is done in the context of a DLI or bilingual. Using a case study methodology allows for the examination of complex social relationships as a “whole, without having to break them down into isolated, incomplete, and disconnected variables” (Hatch, 2002, p. 9). Using a descriptive case study also allowed observation of the negotiation of local classroom identities within the context in which it naturally occurs (Duff, 2008, p. 32). This methodology allowed for a focus on the case of one small heterogenous lab group when attempting to answer the research questions posed in this paper, establishing what the negotiation of local identities looks like in this context, and how this process affects participation and learning opportunities experienced by the participants.

3.6 Discourse Analysis Beyond the Speech Event – Methodological Overview

“Discourse Analysis beyond the Speech Event” (Wortham & Reyes, 2015) was used to analyze the data described above. A method that originates in linguistic anthropology, discourse analysis beyond the speech event as described by Wortham and Reyes (2015) is an iterative process– the goal of which is to identify social action that is occurring across speech events. This is done through multiple steps including mapping out narrated events, or speech that is referring to an event that is not within the immediate spatial and/or temporal context of the speech event. This narrated speech is different than what Wortham and Reyes (2015) call the narrating events, which is speech within the speech event that refers to the immediate context of that event. By mapping out these narrated events within the narrating event, researchers can begin to understand the

positioning of the participants involved in or referred to within a speech event. However, in order to understand why participants are positioned the way they are, how they came to be positioned that way, or to understand how positioning changes, it is necessary that the analyst examine participants' behavior both within and across speech events. Only by looking across speech events can a discourse analyst begin to answer questions about positioning through looking at the emerging pathways of social identification of the participants within the analysis and how those pathways develop, diverge, and solidify into a more permanent identity or positioning.

As well as analyzing across speech events, in order to understand more fully what is occurring in these speech events, Wortham and Reyes (2015) describe the practice of analysts using their knowledge beyond the speech event, meaning that they are using their own background knowledge; whether it be about pop-culture or characteristics associated with certain social groups (emblems). Using this prior knowledge beyond the data collected is important within this research. Since the data used is very temporally limited (3 days) it would be almost impossible to come to any conclusions about the construction and negotiations of the local identities of "scientist" and "good student" (and how Latinx and multilingual identities affect these negotiations) without being able to use this method of analysis.

3.7 Data Analysis

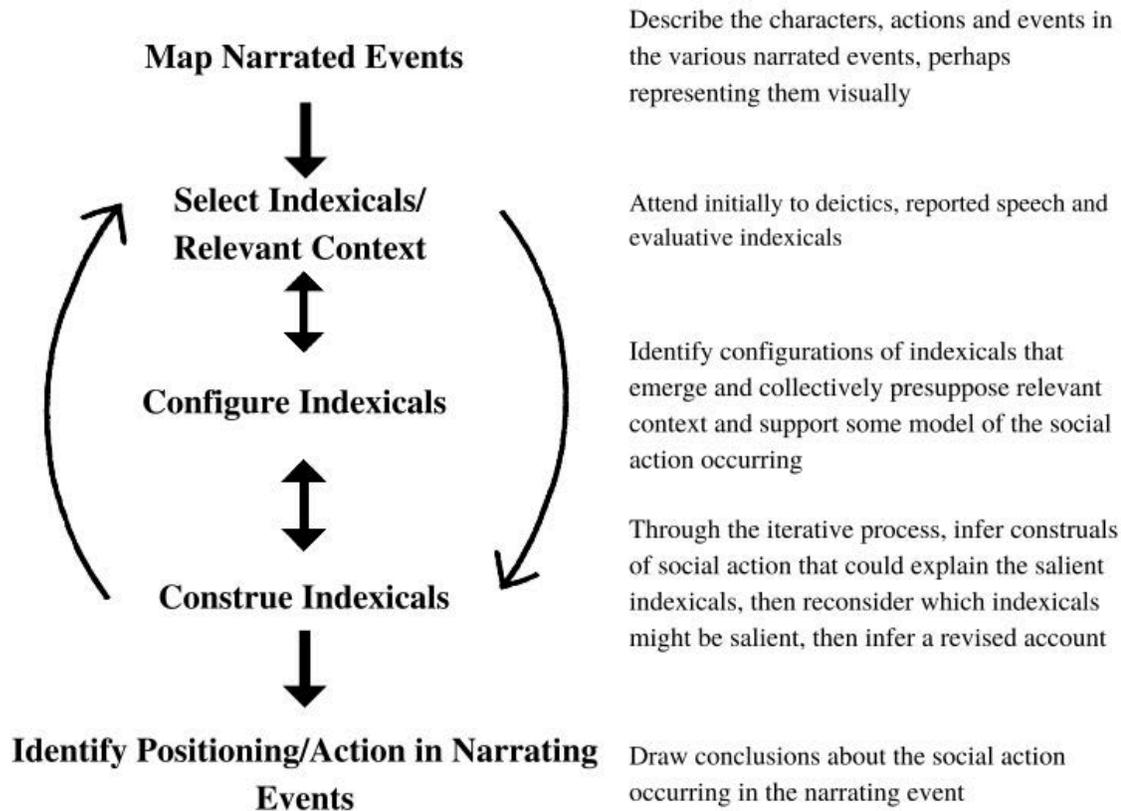
Much of the analysis for this research focused on three aspects that carry information about the narrating event, or "signs" (Wortham & Reyes, 2015, p.5), common in and across speech events that when taken into consideration holistically and inductively reveal social action, or changes in positioning amongst the participants of this

study. Those three aspects are: deictics, reported speech and indexicals (Wortham & Reyes, 2015). Deictics establish the context of a narrating event including the space in which the event is occurring, the time, the people speaking and being referred to, and the reference of people, places and things outside of the immediate spatial and temporal context of the event (e.g. using words like this and that referring to a shared experience two speakers in the event may have). Reported speech is, in short, when one speaker puts words into another person's mouth, whether direct (recounting what someone said) or indirect (hypothetical or predictive). Finally, indexicals "point to relevant context in ways that potentially characterize and evaluate narrated characters and narrating participants." (Wortham & Reyes, 2015, p.51).

In order to complete a thorough analysis of these signs within and across the recorded speech events, the corpus of video and audio recordings for this case includes 4 hours of instruction and peer interaction collected over three days. The recordings were transcribed following linguistic anthropological conventions (See Appendix A). Transcripts and recordings were compiled in a research software (Atlas.ti) and analyzed following the inductive process outlined by Wortham & Reyes (2015) (Table 2.2 and 2.3).

A critical part to the process presented in Wortham & Reyes (2015) is to analyze within individual speech events and to analyze patterns that emerge across multiple speech events. The following is taken directly from table 2.2 in Wortham & Reyes (2015):

Figure 3.1—Analysis within discrete speech events



Discrete speech events were carefully analyzed in this manner. This process revealed instances of how local identities affected students' opportunities to participate meaningfully in scientific conversation which are reported in Chapter 4. However, to establish how discrete social actions can have cumulative impacts on students' classroom identities and participation it is necessary to look *across* the data that were collected across all three days of the study. Discourse analysis *across* speech events was done using the following procedure modeled in table 2.3 by Wortham & Reyes (2015):

Figure 3.2—Analysis across speech events

<p>Phase 1: IDENTIFYING LINKED EVENTS AND MAPPING NARRATED EVENTS</p>	<p>What events are linked in a pathway, through reported speech, parallelism, shared referents or other devices, such that the events might together accomplish some social process? What characters, objects and events are referred to and characterized in the narrated events of these linked discursive interactions</p>
<p>Phase 2/Component 1: SELECTING INDEXICALS AND IDENTIFYING RELEVANT CROSS EVENT CONTEXT</p>	<p>Attending particularly to types of signs that often signal the social action accomplished through discourse, which indexical signs become salient both within and across events? What context do those signs make relevant-attending both to larger social context and to cross-event context, to how signs index other events in the trajectory?</p>
<p>Phase 2/Component 2: CONSTRUING INDEXICALS AND TRACING SHAPE OF PATHWAYS</p>	<p>Which accounts of voicing, evaluation, positioning and social action make sense of salient indexical signs and allow participants and analysts to interpret narrated and narrating events? How do these accounts organize both individual events and the pathway across events?</p>
<p>Phase 2/Component 3: CONSTRUING INDEXICALS AND DELINEATING CROSS- EVENT CONFIGURATIONS</p>	<p>How do salient indexical signs coalesce into stable configurations within and across events, such that relevant context, recognizable types of social action and more rigid pathways are established?</p>
<p>Phase 3: INTERPRETING SOCIAL ACTION AND IDENTIFYING CROSS-EVENT PROCESSES</p>	<p>What account best explains the positioning and social action occurring in the narrating event (or across the pathway of narrating events)?</p>

By using this method of inductive analysis, this study is able to focus on instances and patterns of local identity negotiations within this lab group by looking “beyond a focus on discrete and recurring types of events to study emergent cross-event patterns” (Wortham & Reyes, 2015, p. 171). This method, which focuses on how participants construct and negotiate their identities and social positions within the classroom context fits within the critical-constructivist methodology because it reveals *how* inequities are crafted through language. Rymes (2009) describes how this linguistic anthropological approach is inherently critical and Braden (2020) demonstrates how this method of discourse analysis can be used within a critical framework drawing on critical race media literacy (Yosso, 2002). A critical perspective is crucial within this analysis in order to acknowledge

existing power structures and to create resistance to their effects (Hatch, 2002). These power structures which are made up “of broad social categories like race and gender” are crucial when employing critical discourse analysis, as such an analysis would not be possible without taking into account the social context of the instructional context (Rymes, 2016 p.53).

CHAPTER IV

ANALYSIS

By attending to the indexical and symbolic characteristics of language use in this setting, salient pathways of students' identities emerge from the data. Whenever languaging occurs, social positioning is occurring simultaneously whether it be upholding established identities or challenging them (Wortham & Reyes, 2015). However, when analyzing the data, it would be imprudent to include every instance of discourse recorded. Rather, the segments of transcript presented in this chapter were selected because they illustrate pivotal moments in how students negotiated their identities within the classroom and simultaneously crafted local identities. This analysis will focus on two local identities that emerged from the data 1) the "scientist" and 2) the "good student" and how the identity of being Latinx and a multilingual Spanish-speaker affected the negotiations of local identities. The processes of negotiating and creating local identities do not occur independently, rather, they occur simultaneously, and only through analysis of individual and collective speech events can signs be construed to reveal pathways leading to, or diverging from, these local identities.

The heterogenous lab group in this case study was made up of Miguel, Oscar, and Hope. Miguel and Oscar are both Latinx students and multilingual. Miguel speaks Spanish and English and Oscar speaks Spanish, English, and Q'anjob'al. Hope is a White, monolingual student and Abby, a White, monolingual student, was absent on the first day of collection and joined the lab group for the other two days of group work recorded. Another student, Jenny, a Latinx student, was part of this group for a few minutes on the first day before being reassigned by the teacher to a different group. She

left the group early enough that she is included in very little of the data and subsequent analysis.

4.1 The Science Expert

The local identity of science expert that was crafted within this case study shares signs that point towards a stereotypical “scientist”, a widely circulated model of identity. The signs that are particular to the timescale of this case study and the local identity of “science expert” are the use of criticism, mockery, and ignoring others’ bids at participating in scientific conversations. From the onset of data collection, Miguel was clearly positioned as the local “science expert” as he and his group members engaged in discourse that valued his contributions to scientific conversations more than others in the group.

Excerpt 1 is from the first day of the magnetism unit. In this excerpt, the group has been assigned the task of getting a paperclip to “float” by pulling it into the air with a magnet and pulling the magnet away from the paperclip until the paperclip is suspended midair, not touching the magnet, but still being pulled upwards by its attraction to the magnet. They are then to consider what is occurring within the magnet and paper clip that allows for this phenomenon. Dr. Braden was checking in on groups and engaging them in scientific conversations about the floating paper clip phenomenon. The students and researcher(s)/teacher in Extract 1 include Dr. Sarah Braden (DSB), Miguel (M), Oscar (O), and the teacher (T).

Extract 1

- 570 DSB: So. Initial ideas. What's happening.
 571 M: That the paperclip is floating when the magnet is (attracted) cause the-
 572 the magnet has less force than this part <gesturing to string> and it was
 573 making the this part <holding the magnet and paperclip in his hand> have
 574 more force to do go back.
 575 DSB: Okay. So how does the magnet apply that force. Like if I'm gonna
 576 apply- if I'm gonna push this <miming a pushing motion against the table>
 577 right, that would be a force. But how come the magnet has the- how does
 578 the- how does force work with magnets?
 579 M: [Because
 580 O: [Electricity I guess
 581 DSB: So maybe it has something to do with electricity? So make a--make a
 582 note if you didn't. So like maybe this has something to do with electricity.
 583 Or.
 584 M: It could be possibly gravity too because this part too, you see how that it
 585 goes this way this go to the left.
 586 DSB: °Sorry°
 587 <T has started a whole group discussion. DSB indicates that they should
 588 now be quiet and pay attention to the T>

Despite being the first day of the unit, Miguel is using relevant scientific vocabulary to express his ideas including “force” (Ln 572, 574), “attracted” (Ln 571), and “gravity” (Ln 584). It is important to note that while Oscar’s contribution to this particular speech event was brief, he also used scientific vocabulary (“electricity,” Ln 580) to express himself. Dr. Braden validated Oscar’s contribution (“So maybe it has something to do with electricity”, Ln 581), and perhaps would have pushed him to expand on his thought had their interaction not been cut short by the teacher quieting the class for instruction. However, a key difference between Miguel’s and Oscar’s use of scientific vocabulary is how these signs contributed to their social positionings. In the case of Miguel, his confidence in expressing his ideas using scientific vocabulary continued throughout the unit; this particular speech event fell along a “pathway” paved with similar speech events filled with signs that can be construed to point towards his identity as the group’s science

expert. Miguel's confidence is revealed by his lack of hesitation in explaining the phenomenon of the floating paperclip using scientific vocabulary ("Force", Ln 572, 574) which positioned him as more expert in science, contributing to his emerging pathway that ultimately positions him as the local science expert. Even though Oscar used scientific vocabulary, this instance did not lead to a shift in how science expertise was distributed in the group.

In every instance that a teacher/researcher engaged with the group in a scientific conversation, on the whole, Miguel would talk far more than his peers. In this instance, Oscar and Hope were also present, however, besides one short phrase from Oscar, the conversation is carried out between Miguel and Dr. Braden. Analysis of additional data revealed Oscar's pathway in terms of science expertise being paved in large part by Miguel, as Oscar's bids to contribute to the scientific process were devalued, ultimately positioning him as less expert in science. Extract 2 offers an example of such an instance. At this point on day 1 of instruction, Oscar is attempting to get a paperclip tied to a string to "float" using a magnet at one of the data collection stations. When he feels he has accomplished this, he seeks Miguel's attention. The students in Extract 2 include Oscar (O) and Miguel (M).

Extract 2

378 <O successfully gets the paperclip to "float" using a magnet>
 379 O: I did it, Miguel
 380 M: I'm pretty sure that it's not floating though
 381 O: That's not work
 382 M: Yeah, you ho—
 383 O: Here, you do it
 384 M: Alright
 385 O: I give up
 386 <M sticks the paperclip to a magnet and O knocks it off with his pencil>

At first, Oscar expresses his accomplishment of getting the paperclip to float (“I did it” Ln 379). Miguel’s response is to criticize Oscar’s attempt (Ln 380), telling him that he has not succeeded in the task. Oscar responds to Miguel in agreement (Ln 381), despite having made the paper clip float. He then hands over the materials to Miguel and says, “Here, you do it” (Ln 383) and “I give up” (Ln 385).

This small interaction is not mundane or inconsequential. In this interaction Miguel and Oscar position themselves and each other in terms of scientific expertise. Miguel’s use of criticism (Ln 380) is an indexical sign that points to his identity as a science expert. Oscar’s acceptance of this criticism points to his lack of science expertise. Critically, science expertise is a socially negotiated position, not reflective of internal cognition (Carr, 2010). The power dynamic reflected by the disparity in science expertise permeates every interaction between Oscar and Miguel. Throughout the magnetism unit, Oscar consistently sought to be included in the group and within the process of scientific discovery. However, Miguel’s reactions to Oscar’s attempts at joining the scientific conversation overwhelmingly invalidated Oscar’s voice as a “scientist”, further solidifying each student’s identity in terms of science expertise. One mode of invalidation used by Miguel was sarcasm. Teasing in general is a way through which uneven distribution of expertise and associated power is upheld and further strengthened since those identified as more expert are “permitted to tease or rib individuals in less powerful or subordinate positions without being teased in return” (Lampert & Ervin-Tripp, 2006). Miguel, as the science expert, frequently teases Oscar in a way that invalidates his attempts to make contributions to scientific conversations as is the case in Extract 3. The students in Extract 3 include Oscar (O) and Miguel (M).

Extract 3

335 <O grabs for M's pencil in M's hand>
 336 O: Give me your pencil
 337 M: It had! Oh,
 338 O: Let me see your pencil!
 339 M: Are you going to break it in half? Are you going to break it and test the
 340 lead? <allows O to take the pencil and O tries to get the end of the pencil to
 341 stick to the magnet>
 342 M: You're such a-
 343 O: Doesn't work
 344 M: You're such a scientist, Oscar.

Throughout the magnetism unit, sarcasm was commonly used as a way to invalidate languaging that challenged the existing and solidifying social pathways of expertise within the group. In this speech event, Oscar is testing his hypothesis that lead is magnetic by holding a pencil's lead against a magnet to see if it was magnetic (Ln, 340-341). As a teacher and researcher viewing this experimentation, I would label and validate this exploration as an innovative idea that demonstrates scientific thinking, contributing to Oscar's identity as a scientist. However, as we can see, rather than validating this scientific inquiry, Miguel uses sarcasm in order to make clear the irony of labeling Oscar as a scientist when he has been continually positioned by himself and others as less expert in science. Along with this more explicit method of invalidating attempts at disrupting the expertise/power of the group through teasing/sarcasm, these attempts were also invalidated through students ignoring one another.

In the following extract from day 1, Hope and Miguel are working in their unit work books independently, recording their observations and explanations about the current station at their table. Oscar however, is still interacting with the materials of the station, and in the following extract attempts to engage Miguel in a conversation about

his own scientific exploration (Ln. 207-208). The students in Extract 4 include Hope (H), Miguel (M), and Oscar (O).

Extract 4

205 <H and M are working in their books, O is manipulating the magnets>
 206 O: I found some evidence. This # loop. As you can see. When I put this
 207 almost ##. Miguel. <O is pushing a magnet away with another magnet
 208 without them touching>
 209 M: Shut up. I'm busy right now.
 210 <O makes sound effects as he pushes the magnet closer and closer toward
 211 M>
 212 M: Sweet Jesus
 213 <M and H continue working in their books and O continues to manipulate
 214 the magnets.>
 215 <O grabs a box of paperclips off of the tray>
 216 O: See when I did it I open it.
 217 M: Yeah <not looking up from his book>

Oscar attempts to get the attention of Miguel by using scientific vocabulary (“evidence” Ln 206). When this doesn’t generate a response, Oscar seeks Miguel’s attention by calling his name. This more direct bid to join the conversation resulted in Miguel’s first response of “Shut up. I’m busy right now” (Ln 209). This utterance implies that whatever Oscar could contribute to the scientific process, as someone less expert in science, was not as valuable as what Miguel was working on in his book, as a science expert. In response to Miguel’s willfully ignoring Oscar's attempt at collaboration through scientific speech, Oscar uses his physical presence to persuade Miguel to engage with him by moving into Miguel’s workspace with a magnet. A clearly annoyed Miguel responds with “Sweet Jesus” (Ln 212), and Oscar retreats from Miguel’s workspace. Within this interaction, Miguel again invalidates Oscar’s attempts at being a part of the scientific process by identifying Oscar’s actions as annoying rather than valuable. In the third instance of Miguel ignoring Oscar in this speech event, Oscar again attempts to engage

Miguel in the scientific process by discussing the materials for their current station (box of paperclips) (Ln 215-216). While Miguel responds with “Yeah” (Ln 217), he does not look up from his book and does not continue in a conversation about the materials with Oscar. This instance again puts more value on Miguel’s individual work in his book than any contribution Oscar could make.

These excerpts from the data show how Miguel’s identity as science expert solidified. This identity was stable enough that even when other students performed similar signs (use of scientific vocabulary, teasing, and ignoring others) they were unable to shift science expertise away from Miguel towards themselves through these means. To illustrate this point, the following shows Oscar teasing Miguel. Before this particular speech event, everyone in the group (including Miguel) had successfully gotten the paperclip to “float” (Ln 450, 453). The students and researcher(s)/teacher in Extract 5 include Dr. Sarah Braden (DSB), Miguel (M), and Oscar (O).

Extract 5

450	DSB: How are you guys doing? Did you get it to float?
451	M: Yeah
452	O: Yeah!
453	DSB: Did everyone make it float?
454	O: [Except him! Except him.
455	M: [Yeah yeah yeah. We did. Yeah.

Even though Oscar knows that Miguel had gotten the paperclip to “float” (Ln 450, 453) prior to this interaction, he yells to the researcher that Miguel had not been able to (Ln 454). While this teasing potentially positions Miguel as less expert, and there are other instances similar to this speech event that appear to contradict the distribution of science expertise as described. However, when considering all data collected and analyzed, the vast majority overwhelmingly support Miguel as science expert through his use of

scientific vocabulary, teasing, and ignoring others. While this is an instance of Oscar teasing Miguel, this is a rare occurrence. It was Miguel who more freely and frequently teased Oscar, further evidence of the uneven distribution of expertise and corresponding power (Lampert & Ervin-Tripp, 2006). These speech events create a pathway, and while some events diverge from the majority, like this one, the pathway that emerges is the one that leads to Miguel's role as science expert.

4.2 The Good Student

As discussed in Chapter 2 (2.5), researchers have described the widely circulating model of identity of a good student (Thornberg, 2009; Lundqvist 2019). While the local identity within this analysis of good student shares signs with these stereotypes within this widely circulating model of good student, the local identity of a good student within this case study focuses primarily on students' correction of their peers off-task behavior and carrying out the directives of the teacher/researcher.

As seen in the previous section, an overwhelming majority of interactions in which science expertise was negotiated, Miguel was positioned as more expert. While analyzing interactions in which students within this case study's small heterogeneous science group oversee each other's tasks and/or carry out instructions of the teacher/researcher, it became apparent that negotiations of the identity of science expert are often tied up with the negotiations of the local identity of good student. This interrelated relationship of identities emerged as Miguel was found to be positioned as the good student of the group within interactions more often than any of his peers. However, whereas an overwhelming majority of interactions led to Miguel's identity as a science expert, his role as a good student which was established during the first day of

data collection was more successfully negotiated and dispersed between all group members with the exception of Oscar. Examining whether students' attempts at positioning themselves in the role of good student were accepted or challenged reveals the entanglements with the local science expert identity.

First day of data collection

During the first day of data collection, the group consisted of Miguel, Oscar, and Hope. Just as Miguel's role as science expert emerged on the first day of data collection almost exclusively through his interactions with Oscar, Miguel's good student identity was negotiated in a very similar manner, and often these negotiations occurred simultaneously. Speech events positioning Miguel as a "good student" on this first day were characterized by Miguel invalidating Oscar's bids to meaningfully participate through criticism and redirection. In the following extract, Oscar is manipulating magnets given to the group, Miguel responds by criticizing and devaluing this behavior as off-task. The students and researcher(s)/teacher in Extract 6 include Oscar (O) and Miguel (M).

Extract 6

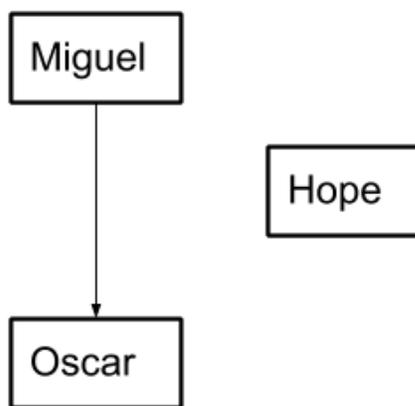
327 <O and M work together to see how many paperclips a magnet can pick
 328 up through a stack of papers. O then takes the magnet and holds it upside
 329 down to see if the paperclips will continue to stick>
 330 M: Oscar
 331 O: Stop it, it's mine <O continues to hold magnet away from M>
 332 M: Oscar
 333 O: ##. [##
 334 M: [You're being childish right now
 335 O: I'm a child
 336 <O continues to hold the magnet, papers, and paperclips. He changes the
 337 topic of the conversation to be about clothing>

Initially, Miguel attempts to stop Oscar's perceived off-task behavior by physically taking the magnets away from Oscar. Oscar draws away from Miguel telling him to stop (Ln 331). Miguel, clearly annoyed, repeats Oscar's name impatiently (Ln 330, 332), and finally, when it is clear that this approach would be unsuccessful, he abandoned his efforts at taking the magnets from Oscar, and instead labeled Oscar's behavior as "childish" (Ln 334). This labeling of "childish" is accepted by Oscar when he labels himself as "a child" (Ln 335). After this speech event, rather than challenging this labeling of being "childish" (Ln 334) and subsequent positioning of less capable of a leadership role, Oscar changes the topic to a conversation about clothing (Ln 336-337).

While most of the negotiations of the good student role occurred between Oscar and Miguel on this first day of data collection, Hope was also present as a part of the group, though she spoke less frequently than her peers. During this first day, while Hope was present, she, on the whole, played the role of a silent participant, and although this role is not inherently problematic (Remedios, Clarke, & Hawthorne 2008), an important aspect of Hope's emerging identity within this case study is that she became more verbal and active in her own positioning when another student joined the group on the second day. This lack of interaction on the first day, however, left Miguel's role as a "good student" undisputed by Hope. The hierarchy of the group in terms of the "good student" identity that emerged from analyzing speech events from the first day can be seen below in Figure 4.1. The accumulation of signs within the interactions between Miguel and Oscar point to Miguel invalidating Oscar's attempts at meaningful participation and access to the "good student" identity, positioning Miguel above Oscar within the emerging hierarchy of this role. Because of the lack of speech events involving Hope, it

was difficult to interpret her position among her peers. Placing her name to the side and in a neutral position between Miguel and Oscar illustrates how the accumulation of signs from this first day point to Hope's position as the silent participant in the group.

Figure 4.1—Positioning of good student identity, 1st day of data collection



Second day of data collection

The group dynamic begins to shift with the introduction of a new team mate, Abby, on the second day within this case study. Hope's emerging identity within the group is particularly affected, as she moves from being a mostly silent participant to playing a more active role in her own positioning. This could be due to a number of personal factors, including the fact that adding an additional female student to the group, Abby, has shifted the dynamic of the group away from being male dominated, positioning Hope (and Abby) to better dismantle the positioning of her male peers in a science context in which males are generally positioned as more knowledgeable (Banchefsky & Park 2018; Nosek & Smyth 2011). While this balance in gender distribution could very well have contributed to Hope's behavior and positioning in the group, the analysis for this thesis will focus on Hope's positioning as a good student through her task management of Abby

as she carried out the teacher/researcher's instructions. This positioning was initiated by the Teacher when she asked Hope to tell Abby what page in the workbook she should be working on since Abby had been absent the day before and was unfamiliar with the procedures associated with the magnetism unit. This request for Hope to assist Abby has implications for the group dynamic going forward as, after this instance, Hope continues to position herself as a "good student", and a better student within her interactions with Abby. In the following extract, the group is supposed to be observing the temporary magnetization of a nail after rubbing it with a magnet. The students and researcher(s)/teacher in Extract 7 include Abby (A) and Hope (H).

Extract 7

676 <The lab group has a new station at their table that is supposed to
697 demonstrate the temporary magnetization of a nail.>
698 A: (I don't even know what I'm supposed to do with this)
699 H: You rub it. Go like this fast
700 A: (I don't want to do anything)
701 H: Hey, hey. I'm trying to make you laugh. (3.0) Hey can you hand me the
702 nail so I can rub it? <H turns to M, gesturing at a nail next to him>
703 A: I don't (want to) do anything.
704 H: Okay, this is what you do <holding magnet and nail so that A can see>.
705 And rub it fast. Okay, now connect

This speech event begins with Abby expressing confusion and frustration about the activity they have been assigned as she is holding a nail and magnet (Ln 698). Hope responds by providing Abby with instructions (Ln 699), this sign positions Hope as more knowledgeable and capable of leadership within the group, and more specifically, within Abby and Hope's relationship. Abby challenges Hope's attempt at instructing her by responding with "I don't want to do anything" (Ln 700), essentially rendering Hope's instructions ineffectual. Hope responds humorously with "I'm trying to make you laugh" (Ln 701). This response may be an example of using humor in order to foster group

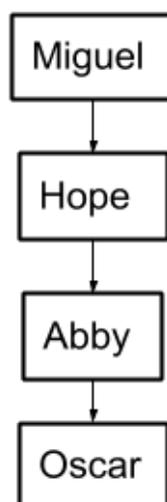
cohesion (Meyer, 2000), to ease the friction caused by Hope positioning herself as a good student through attempting to instruct Abby in her learning. After Hope asks for and receives a nail from Miguel in order to show Abby how to complete the task of magnetizing the nail (Ln 701-702), Abby reiterates her desire to withdraw from the activity (Ln 703). However, Hope persists and both Hope and Abby rub magnets on each of their own nails and then attempt to “connect” their nails to paperclips on the table (Ln 704-705). While Abby resisted and challenged Hope’s leadership in this extract, the speech event ended with Abby carrying out the task Hope instructed her in. Because of this, this speech event further strengthened Hope’s emerging identity as a good student.

It is important to note that this is an example in which multiple identities are being negotiated simultaneously. While this extract was chosen in order to demonstrate Hope enforcing instructions described by the teacher/researcher, this is occurring while investigating a scientific phenomenon. However, unlike extracts shared in the previous section on science expertise which illustrate interactions in which science meaning was negotiated, this extract is procedural in nature. Both before and after this speech event, while Hope and Abby interacted with their table’s station, this did not lead to a conversation related to science concepts.

Hope’s emerging identity as good student within her interactions with Abby begins to challenge Miguel’s position as the group’s sole good student. This greatly contributes to the hierarchy of the good student identity that emerged from the data seen in Figure 4.2 below. There are instances of Miguel, at the top of the hierarchy, instructing all of his other peers and carrying out classroom objectives regularly. Positioned below him is Hope, who while there are instances of her instructing all of her peers, she seldom

instructs– or successfully instructs– Miguel’s participation. Abby is often critical towards Oscar, framing his behavior as off-task and positioning herself as more capable of being a good student; however, within her interactions with other group members, Miguel and Hope are often the ones correcting or directing Abby’s participation. Oscar’s position at the bottom of Figure 4.2 illustrates his solidifying identity in terms of the local identity of good student through his interaction with his peers in which he is consistently positioned as less capable carrying out the signs pointing towards the identity of good student.

Figure 4.2–Positioning of good student identity, 2nd day of data collection



Third day of data collection

Despite the fact that Hope does not contest Miguel’s position of sole good student nearly as often on this day of data collection, it is on the third day that Miguel’s identity as the sole good student is most disputed. On this day, a new instructional scaffold was introduced with the goal of creating a rotating leadership position in which each student took a turn in facilitating a component of the conversation related to building consensus models in their group. This new scaffold, implemented in order to foster more equitable

participation, could very well have contributed to the increase in disruptions of emerging/established identities within the group.

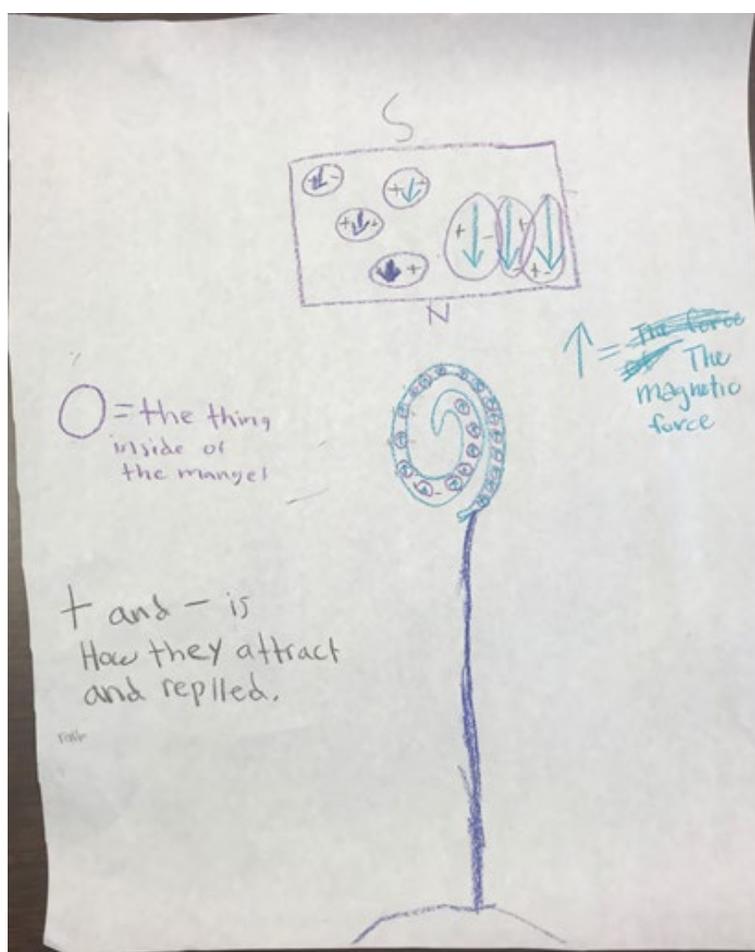
By the third day of data collection, perhaps due to the fact that Abby has acclimated more to her group and to the format of the magnetism unit, Abby and Hope's interactions are not as often marked by Hope being positioned as a good student. Because Hope's positioning as a good student on the second day was integral to directing Abby's participation, Hope's interactions within the group are no longer pointing towards being positioned as above Miguel in terms of the good student identity. This is despite the fact that Hope still instructs her peers at times.

Whereas Hope disputed Miguel's identity of good student on the second day by also positioning herself as a good student, on this day we see Abby disrupt the existing hierarchy not only by asserting herself as a good student through instructing and directing her peers, but also through criticizing Miguel's capability of fulfilling the identity of good student. The resulting dynamic of good student identities is one that is much more fluid than was seen on previous days. Despite more frequent disputes regarding Miguel as a good student, he still has more instances of directing his peers' tasks than any other group member. Unlike the first day however, instead of directing only Oscar's participation, he now actively directs Abby and Hope's participation as well.

In the extract below, the students are working on one piece of poster board to draw their consensus model. Miguel has been assigned as group leader while the group draws their consensus model together. While Miguel is assigned in this role, this assignment, as will be seen below, was not challenged by his peers. This is still significant when considering how Miguel is positioned within this group as Oscar, even when assigned the role of

In line 129, Miguel has turned to Abby, instructing her to draw arrows on their group model, incorporating arrows found in her individual model. Abby moves the drawing of the group's model closer to herself and proceeds to draw arrows on the drawing of the group's model closer to herself and proceeds to draw arrows on the group's model (see Figure 4.3). In this speech event, all three of Miguel's peers accept without challenge Miguel's position at the head of the group's "good student" hierarchy by following his instructions as he carried out the directives of the teacher/researcher.

Figure 4.3—Group's drawn consensus model



On the third day there are instances of Abby, Hope and Miguel all vying for the position of "good student". At times, all three students would make moves to wrestle the position of "good student" away from one another within the same speech event, as in the extract

below. To prepare students for the consensus building process, students were asked to each independently share their models with their group members one at a time. In this following extract, it is Abby's turn to share her independent model explaining the phenomenon of the floating paper clip. The students in Extract 9 include Hope (H), Abby (A), and Miguel (M).

Extract 9

582 <The T instructed the groups to share their individual models of the
 583 "floating" paperclip phenomenon and it is A's turn to share her model>
 584 H: You're the leader
 585 A: Ya'll need to stop being so disrespectful to the leader
 586 M: Okay [(let's start)
 587 A: [Ya'll need to start listening to the leader
 588 M: Okay, speak
 589 A: Alright

This speech event begins with Hope informing Abby that she is now the "leader" (Ln 584), a way to instruct her to begin presenting her model. In response to this instruction, Abby criticizes her group for not respecting her as the leader (Ln 585). Miguel then tried, as Hope did, to instruct Abby to begin explaining her model. Again, Abby responded in a way that criticized the group for not acting in an appropriate way while she is the leader. However, despite the fact that Abby has challenged both Hope and Miguel's attempt at directing her participation, when Miguel instructs her again to speak, Abby concedes with "Alright" (Ln 589) and begins to present her model. This speech event, while showing that Abby actively positioned herself in the role of group leader and contested challenges to that positioning, ultimately ended with Abby conceding to Miguel's leadership, positioning Miguel above Abby in the "good student" hierarchy.

Throughout the third day of data collection, Abby continued to position herself as a "good student" by actively criticizing Miguel. Unlike science expertise which was not

successfully negotiated between group members (Miguel ultimately being positioned as the group's science expert), Abby was particularly successful in disrupting Miguel's place at the top of the "good student" hierarchy. This is evident as Miguel begins to not only allow Abby to act as a "good student" unchallenged but also seeks out Abby's approval for his own tasks. This can be seen in the following extract in which the group is drawing a model together and Miguel and Abby ask each other about what to include.

The students in Extract 10 include Miguel (M) and Abby (A).

Extract 10

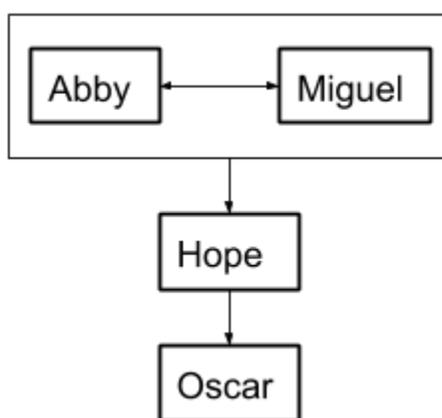
269 M: So I draw the negative and positive ##?
 270 A: Sure
 271 M: Alright
 272 A: What are we—
 273 M: Huh?
 274 A: Do we describe them or—
 275 M: What do they mean?
 276 A: Stuff like that? <Shows book>
 277 M: Hm?
 278 <A points at drawing>
 279 M: Yeah, we should do that. Okay so you do blue- I do- Oscar- I do pink,
 280 purple. Do you know?
 281 A: Hm?
 282 M: Is that okay?
 283 <A nods>

This extract shows that both Miguel and Abby seek for the other to instruct or direct their contributions to the group's consensus model. Miguel does this by asking Abby whether or not to "draw the negative and positive" (Ln 269) and if his plan for the moving forward is "okay" (Ln 282). Abby seeks Miguel's instruction by asking about whether or not they need to write descriptions on their models (Ln 274), and what these descriptions should look like (Ln 276). This interaction from the end of the third day of data collection shows that Abby and Miguel have created, at least in this speech event, a group dynamic

in which they share the role of “good student” and arrive at consensus in creating a group model.

These interactions, when analyzed, reveal an emerging hierarchy of the identity of the “good student” within the group with Miguel and Abby at the top of the hierarchy, sharing the position, above their peers, of “good student” . Below them, Hope acts as both someone who is instructed and directed by Abby and Miguel, but who is also in a position of more power than Oscar, who is at the bottom of the group’s hierarchy, meaning that while he is subject to the instruction of all other peers, he himself is not positioned to direct anyone else’s tasks.

Figure 4.4—Positioning of good student identity, 3rd day of data collection



4.3 Latinx and multilingual identities and their effects on negotiation of local identities

While the local identities of “scientist and “good student” are negotiated within the speech events discussed in this chapter, while analyzing the data, it became evident that there was a particular type of speech event that, while not explicitly affecting the negotiation of the local identities of “scientist” and “good student” and the associated power of these positionings, implicitly affected students emerging identities within the

group. These are interactions in which students engage in meta-commentary (Rymes, 2016) about languaging, in particular when group members position themselves as more expert in English than other group member(s). Oscar and Miguel, both multilingual students, were the only ones targeted in this way. This type of positioning made more salient the identities of being multilingual students in Oscar and/or Miguel. Which, as Spanish speakers, Spanish having been co-naturalized with the identity of being Latinx, also served to make more salient this racialized Latinx identity. Being a multilingual student in a K-12 setting in the U.S. comes with widely held stereotypes about Latinx students whose first language is not English as not being as successful as their White peers in academic settings (Blaine 2013; Jimeno-Ingrum et al. 2009). Because of this, by making salient Oscar's and Miguel's identities as Latinx and multilingual students through this type of positioning had real effects on how they were positioned in terms of being a "scientist" or "good student". The very first speech event recorded in this case study was a conversation between Miguel and Oscar in which Miguel challenges Oscar to repeat a tongue twister. The students in Extract 11 include Miguel (M) and Oscar (O).

Extract 11

193 <M and O have entered the classroom before class has started and are the
 194 only students at their table at the time of this interaction>
 195 M: Oscar, are you- are you- are you good with words.
 196 O: No.
 197 M: Okay, never mind.
 198 O: Why.
 199 M: I want to see can you can say this word five times fast. She shells
 200 she shell by the seashore.
 201 O: She shell [°#####°]

Miguel begins by asking Oscar if he is "good with words" (Ln 195), to which Oscar replies, "No" (Ln 196). Already within this speech event, Miguel and Oscar have been

positioned as more and less expert in English, respectively. As the conversation continues, Miguel offers a tongue twister for Oscar to attempt (Ln 199-200). It is important to note, that Miguel's recitation of the tongue twister is not correct, however, his position as more expert in the English language becomes apparent as this is not challenged by Oscar. Instead, Oscar attempts the tongue twister, transitioning to whispering it quietly so that it is not possible to hear (Ln 201).

Another example of Miguel positioning Oscar as less expert in English is from the first day of data collection. Before this interaction occurred, during a class discussion, Miguel volunteered Oscar to read instructions in front of the class. Oscar read the instructions, but it was obvious from his slow speech rate and pauses that reading aloud in English was laborious for him. Because Miguel volunteered Oscar to read aloud in this scenario and it resulted in Oscar's public struggle to read in English, it can be seen as a way that Miguel positioned Oscar as less proficient in English. Even if this public performance also acted to normalize and legitimize the presence of inexpert English in the classroom. Not much later, the following interaction occurred. The students in Extract 12 include Miguel (M) and Oscar (O).

Extract 12

- 90 <The group is supposed to read instructions from their work books
91 together. This interaction is after M had volunteered O to read aloud in
92 front of the entire class revealing that O had difficulty in reading aloud in
93 English>
94 M: Congratulations Oscar you've been promoted to read this whole
95 paragraph.
96 <O gets up from the table>
97 M: Oh I'll do it for you then.
98 <M begins to read the instructions with no difficulty>

In this interaction in their small group work, Miguel, again volunteers Oscar to read aloud (Ln 94). Considering the interaction preceding this one, in which Oscar was volunteered by Miguel to read in front of the class, this act explicitly positions Oscar as less expert in English and subsequently less expert in science. This is evident by Oscar's reaction of walking away from the table to avoid reading aloud (Ln 96). In response, Miguel says that he will read in his place (Ln 97), alluding to the fact that he is more capable, or expert in reading aloud in English. Which is supported by the ease with which he is able to read the instructions in English to the group (Ln 98).

These first two examples, while occurring between two multilingual students, show a pattern of positioning of English expertise that mirrors positioning occurring in the negotiations of other local identities of the classroom ("scientist", "good student"). This pattern of positioning as less expert across domains is evidence that multilingual students face the particular challenge of positioning themselves as experts due to their lack or perceived lack of English expertise.

Both of these examples are drawn from the first day of data collection. Just as Oscar's positioning within the identities of "scientist" and "good student" are seemingly related to how he is positioned in regard to his expertise in English, Miguel's positioning as more expert in science and as a "good student" is also related to how he is positioned vis a vis English expertise. It is compelling that on the second and particularly on the third day when Miguel's identity as a "good student" was disputed the most, Miguel's identity as a multilingual student was made more salient primarily by Abby, a monolingual, White, English-speaking student that frequently challenged Miguel's identity as a "good student" within the group. In the following extract, Hope asks Abby whether or not she can

understand Oscar when he speaks. The way in which Abby responds dismantles Miguel's science expertise by making more salient his identity as a multilingual student and devaluing the use of other languages besides English. The students in Extract 13 include Hope (H), Abby (A), Miguel (M), and Oscar (O).

Extract 13

749 H: Can you understand what he's saying sometimes? <to A about O>
 750 A: Which one
 751 M: Who
 752 H: Him <pointing to O>
 753 A: I don't understand what either one of them is saying [half the time.
 754 M: [Who
 755 O: [Sí, porque (no se aprende)
 756 A: Huh?
 757 M: @@@@
 758 O: Sí, porque no se [aprende
 759 A: [You got something to say Oscar cause I can
 760 understand that
 761 M: What did he say?
 762 A: °He called me a bitch°
 763 M: That's not what Oscar he was saying
 764 O: #####. #. ##. <O speaking to A in Q'anjob'al>
 765 M: Nice Oscar
 766 H: Wa- he just called you a shrub. I'm just [(kidding)
 767 O: [##. It's a different language
 768 M: Yeah, Spanish
 769 O: No, it's Q'anjob'al.

Abby responds to Hope's question about whether or not she can understand Oscar (Ln 749) by labeling both Oscar and Miguel as "them" (Ln 753), and as both of them being difficult to understand. Because Miguel's expertise in science is marked in large part to the way in which he is able to engage is scientific conversation in English, by implying that he is not understandable depreciates his use of scientific vocabulary as a signifier of his science expertise. In addition to devaluing Miguel as a science expert, later in the speech event, in response to Abby saying that she does not understand Oscar or Miguel

half of the time (Ln 753), Oscar says, in Spanish, that it is because Abby “no se aprende” (referring to the fact that she has not learned Spanish) (Ln 755, 758). While Abby says that she can understand what Oscar is saying, she assumes that he is swearing at her in Spanish (Ln 762). Later, when Oscar speaks in Q'anjob'al, Hope interprets this as him calling Abby a shrub (Ln 766). This assumption that Spanish would be used, not to contribute productively to the conversation, but to demean his peers, devalues his use of both Spanish and Q'anjob'al, or in other words, any language used that was not English.

This interaction is a continuation of the positioning of Oscar as less expert in English, however, instead of Miguel positioning him in this way, Abby and Hope, both monolingual English speakers, are the ones who are positioning both Oscar and Miguel as less expert in science. This interaction, which happens on the third day of data collection coincides with the most challenges made to Miguel's role as a “good student”. One reason that challenging Miguel's identity of being a “good student” was so successful on this day is in large part attributed to Miguel's identity as a multilingual and Latinx student, which became more salient through Hope and Abby's positionings. The associated stereotypes with being a multilingual and Latinx student positioned Miguel as less capable of being a “good student”. It is only after this interaction that Miguel seeks help and validation from others in negotiating the activities of developing their model (e.g., extract 10).

Although I divided this analysis chapter into three sections to clarify dimensions of social identification in relation to local identities, as well as draw connections to socio-historical identity models that were invoked in the context of the science classroom, ultimately, these identities were intertwined with particular consequences for the

multilingual and racially minoritized students in the group. Even when Miguel, a Latinx and multilingual student, was positioned as the most expert in science and as a “good student”, his ability to articulate these positions rested in part on his positioning with respect to English expertise. Consequently, at the same time that his positioning represents resistance to Latinx stereotypes, he nonetheless inadvertently participates in reproducing a language ideology that reifies English expertise and positions it as necessary for demonstrating expertise in science through constraining Oscar’s ability to participate meaningfully in scientific conversation.

CHAPTER V

IMPLICATIONS

In this case study, one of the purposes of the designed instruction was to encourage more equitable small group participation through scaffolded scientific conversations. However, as revealed in the analysis, these scaffolds did not mitigate the ways in which Oscar in particular was barred from positioning himself in roles of expertise. Both Oscar and Miguel's multilingualism contributed to them being positioned as less expert in science and less capable of being a "good student". Oscar and Miguel's use of languages other than English were not interpreted as valuable to the scientific conversation. Dr. Braden at times would use Spanish to talk with Oscar and Miguel, but it was always to convey procedure (e.g. who is presenting next), not to negotiate scientific explanations of the phenomenon. In another notable instance of the use of Spanish and Q'anjob'al, Abby and Hope assumed that these languages were being used to swear and to call Abby derogatory names. This assumption that using Spanish or Q'anjob'al could not contribute to the scientific conversation in the same way as English is an assumption that can be challenged by enacting translanguaging pedagogy.

In order to address the social positioning that occurs within STEM contexts in relation to stereotypes surrounding what it means to be a Latinx and multilingual student, and particularly a Spanish speaker, it is imperative to explore possible solutions that shift the way languages outside of English are valued within educational contexts.

Historically, pedagogical practices aimed at validating home languages have focused on language brokering and code-switching (Champlin, 2016). While both of these practices encourage the use of multiple languages in a classroom, much research regarding code-

switching is done within a monolingual paradigm that views multilingual students as the sum of two or more discrete languages (Li & Luo, 2017). Translanguaging on the other hand, rather than viewing bilingualism as “a bicycle with two balanced wheels”, views multilingualism as an ATV with wheels that “extend and contract, flex and stretch, making possible, over highly uneven ground, movement forward that is bumpy and irregular but also sustained and effective” (García, 2009, p.45). This definition of multilingual practices enables educators to encourage students to use their full linguistic repertoire in a flexible way, enabling them to participate meaningfully in the classroom.

Because translanguaging views one’s linguistic repertoire as something that should be employed in its entirety to best enable the speaker to navigate their local context, it challenges a pervasive deficit mindset that surrounds students whose first language is not English or who may speak varieties of English that are traditionally undervalued in schools. This is particularly important in the classroom when multilingual students' contributions are only valued when expressed in a particular variety of English. This leads to a fragmented view of multilingual students’ ability and knowledge and constrains the local identities available to students. A translanguaging perspective allows educators to gain a more holistic view of a student’s prior knowledge and individual learning needs which are informed by students’ linguistic resources (Li & Luo, 2017).

Within the local context of this case study, a 7th grade science classroom that was using NGSS (Next Generation Science Standards), which focuses on students collaboratively creating a “coherent and scientifically-based view of the world around them” (NGSS Lead States, 2013), it is particularly important to enable students to contribute meaningfully to scientific conversations. In this case study, even though Oscar

was proficient enough in English to contribute to explaining the scientific phenomenon of the floating paperclip, the stereotypes associated with his identity as Latinx and a multilingual student affected the ways in which he was positioned within this small group and subsequently, devalued his contributions. This type of deficit thinking towards multilingualism is combated by translanguaging pedagogies which “position students as bilingually competent and encourage them to invest in bilingual identities” (Palmer, Martínez, Mateus & Henderson, 2014, p.766).

Research has found that translanguaging in a science classroom can help students negotiate meaning of scientific vocabulary by moving between languages as well as formal and everyday discourse (Karlsson, Larsson, & Jakobsson, 2018). When students engage in translanguaging, they are better able to find their own voice when explaining scientific phenomena (Brown et al., 2016). Specific practices that can contribute to encouraging translanguaging in the classroom include: (1) creating assignments that require students to utilize multilingual and multimodal sources; (2) framing assignments to focus on concepts, encouraging students to utilize their full linguistic repertoires; (3) framing multilingualism as an asset through explicit classroom conversations and procedures in order for students to be able to “take linguistic risks without fear of humiliation or marginalization” (Poza, 2015, p.15).

Much research done in regards to translanguaging contexts has been done in DLI (dual language immersion) or bilingual classrooms (Li & Luo, 2017; Palmer, Martínez, Mateus & Henderson, 2014; Poza, 2018) despite the fact that the majority of multilingual students in the US find themselves in classrooms in which the language of instruction is exclusively English, and students are expected to use academic English to express

themselves. Arguably the most formidable obstacle in supporting linguistic practices that challenge the exclusivity of English status quo in U.S. K-12 schools is the overwhelming number of educators who are White, monolingual English speakers. Many of these teachers enact their language ideologies in the classroom, including enforcing stringent code-switching practices which view students' languages as separate and appropriate only in certain contexts (e.g. academic English in the classroom) (Daniels, 2018). By enforcing codeswitching, teachers erase "the impact of their Whiteness and (deny) the mutually constitutive relationship between race and language" (Daniels, 2018, p.166)

A way that teachers, including White teachers, can combat this imposed erasure of other languages (and subsequently other races), is through targeted class discussion addressing social issues and unspoken assumptions associated with language in order to create a "cycle of language awareness and social change" (Rymes, 2020, p.11). This type of classroom discourse analysis should also focus on specific ways students' communicative repertoires affect the way they interact with their peers and ways in which they can better validate each other's contributions (Braden, 2020). Beyond encouraging translanguaging in content classrooms, researchers advocate for assignments or projects that explicitly explore translanguaging within students' lives (including students' home lives), positioning the students as sociolinguists or ethnographers in their own lives to analyze ways in which to utilize and appreciate their full linguistic repertoires (Heath, 1984). In the context of this thesis, this would involve students reflecting on ways they facilitated their peers' access to the scientific conversation of their lab group and how linguistic norms of the classroom affected these interactions. These discussions can shift the way students think of multilingual students and the

associated widely circulating models of identity of Latinx students, sending “a powerful message that their home language practices are integral to the development of their academic identities rather than simply a bridge at best or a barrier at worst” (Flores, 2020, p.28). These practices make it possible for teachers, even those that do not share the same linguistic or racial background as their students, to create an environment in which students have access to their entire linguistic repertoire to engage in scientific meaning making. The creation of spaces that validate students’ linguistic repertoires allows for an expanded conception of what expertise in science sounds like, and creates more opportunities for multilingual students to position themselves in roles of expertise.

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APPENDIX A

TRANSCRIPTION CONVENTIONS FOR CLASSROOM DISCOURSE

Symbol	Meaning
.	End of intonation unit; falling intonation
,	End of intonation; fall-rise intonation
?	End of intonation unit; rising intonation
!	Raised pitch and volume throughout the intonation unit
°°	Lower volume
:	length
-	Self-interruption; break in the word, sound abruptly cut off
(p.p)	Measured pause of greater than 0.5 seconds
@	laughter
[]	Overlapping speech
()	Uncertain transcription
#	Unintelligible; each token marks one syllable
< >	Transcriber comment, nonverbal noise, gesture, or gaze